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WORKING-PLAN

FOR

THE RESERVED FORESTS

OF THE

DEHRA DÚN DIVISION,

SCHOOL CIRCLE, NORTH-WESTERN PROVINCES AND OUDH,

FOR A PERIOD OF FIFTEEN YEARS

FROM 1888 TO 1902.

BY

E. E. FERNANDEZ, Esq.,

OFFICIATING DEPUTY DIRECTOR OF THE FOREST SCHOOL, DEHRA DUN.

No. $\frac{350F.}{682-11}$ OF 1888.

RESOLUTION.

REVENUE (FORESTS) DEPARTMENT.

Dated Naini Tal, the 26th June, 1888.

READ the undermentioned papers:—

(1) Working Plan of the Dehra Dún Forest Division.

(2) Letter from the Inspector-General of Forests to the Government of India, No. 565, dated 23rd July, 1887.

(3) Letter from the Commissioner, Meerut Division, No $\frac{4939}{IV-191}$, dated 10th April, 1888.

(4) Letter from the Conservator of Forests, School Circle, No. 13, dated 26th April, 1888.

RESOLUTION.—In his letter quoted in the preamble, the Inspector-General of Forests to the Government of India intimated that a proof copy of the Working Plan for the Dehra Dún Forests would be forwarded to this Government for consideration and orders: the whole edition of 100 copies has, however, been printed without the previous submission of the proof copy, and in consequence the alterations which the Lieutenant-Governor and Chief Commissioner considers desirable have been reduced to the smallest number possible. In His Honor's opinion, a more detailed system for the treatment of the sissu and khair forests than that given in the Working Plan is necessary; and after consultation with the Conservator of the School Circle, he is pleased to direct that in those forests, simultaneously with sissu thinnings, khair trees more than nine inches in diameter shall be coppiced down over one-fifteenth of the entire area per annum, commencing with the Kachar and Saura Siroli block. At the same time the whole area of the sissu and khair forests should be protected against fire, and the thinned portions against grazing, until the coppice shoots are strong enough to allow grazing with impunity.

The financial forecast given in Chapter VI of the Working Plan is probably too sanguine with regard to the receipts from sál exploitations: the local revenue officials would estimate the rate at considerably less than Rs. 17 per acre.

With increased work it is possible that additional rest-houses may be required; but proposals for expenditure on new buildings or communications, as well as for increased establishment, must be defended in each case by strict proof of their necessity. The proposals for fire conservancy in Chapter III of the Working Plan are accepted, and with the above modifications and reservations the Lieutenant-Governor and Chief Commissioner is pleased to sanction the Working Plan for the reserved forests of the Dehra Dún Division for a period of 15 years.

J. WOODBURN,

Chief Secy. to Govt., N.-W. P. and Oudh.

No. $\frac{351F.}{682-12}$.

Copy forwarded to the Inspector-General of Forests to the Government of India, for information.

No. $\frac{352F.}{682-13}$.

Copy also forwarded to the Commissioner, Meerut Division, for information.

No. $\frac{353F.}{682-14}$.

Copy, with 99 copies of the Working Plan, also forwarded to the Conservator of Forests, School Circle, with the request that an index of contents be prepared: that the Working Plan be bound in a stiff cover, together with a copy of this Resolution and of the index: that 58 copies be re-submitted to Government, and that the remainder be distributed to Conservators as directed in standing orders.

By order, &c.,

W. H. L. IMPEY,

Under-Secy. to Govt., N.-W. P. and Oudh.

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INTRODUCTION

THE preparation of the following Working-Plan was taken in hand in November 1882, when field work was commenced by a party composed of the following officers:

Mr. E. E Fernandez, Superintendent of Working-Plans;

Mr. A. F. Broun, Officiating Deputy Conservator of Forests; and

Mr. Clifford, Assistant Conservator, recently arrived in India

The work was closed on 18th April following. In November 1884 it was resumed by Mr. Fernandez, assisted by students, and continued up to 15th June 1884. Mr. Clifford's services were available only during one month for the examination of the Tháno Forest. Some data were still wanting, and these were gradually collected during the spring of 1885.

At first the field work was started on the same basis as that in Kumáon, that is to say, compartments not exceeding one square mile were formed, and within each compartment all trees belonging to the principal species above a certain girth were classed and counted. But it was soon perceived that, in dealing with such a large aggregate area as that of the forests of the Dehra Dún Division, and with forests containing so small a proportion of large timber, it would be better to adopt a more expeditious system, especially as the institution of the Forest School rendered the early organisation of these forests a matter of the first importance. Accordingly, at the suggestion and with the consent of the Inspector General, it was decided to treat, if ultimately found convenient, each existing block as an individual compartment, but to detach from the area to come under the General Working-Plan, the Lambiráo and Rámnagar blocks of the Tháno Forest, together with any adjoining patches of sal-bearing land in neighbouring blocks, and to organise this limited area as a separate working circle with as much accuracy and minuteness of detail as circumstances permitted. The idea underlying this proposition was to manage and treat the working circle as strictly as possible in accordance with the most advanced principles of sylviculture for the special benefit of the students of the Forest School, who could thus be shown certain model operations.

Accordingly, in the Lambiráo and Rámnagar blocks, and in the adjoining sal-bearing portions of the Sirion and Bidhalna blocks (a total area of about 5,400 acres), every stem three inches and upwards in diameter was gauged and classed. The numbers of the different size-classes of the following six species, or groups of species, were registered separately:—sal, sain, sissu, khair, inferior species attaining the same height as sal and sain, inferior species of a low habit.

The reason for separating the two last groups is obvious. Inferior species of a low habit can affect the growth of only the younger stems of the valuable species; although they may interfere with good reproduction, yet they are easily controlled, and they certainly shelter the soil, while still yielding a considerable quantity of firewood. On the other hand, the trees composing the other group can always constitute an integral part of the leaf-canopy, and can maintain a more or less equal struggle with sal, the growth of which they may at any time injure; and besides this, they can most of them furnish timber. The minimum diameter of the smallest class was fixed as low as three inches, as it was found convenient to consider every stem of smaller size as advance growth. To be consistent with the detailed character of the enumeration survey, small compartments, averaging only 90 acres, were formed. Numerous felled trees were carefully measured for the determination of actual contents and reducing factors.

Over the remainder of the area the examination of the ground and the growth was effected in a much more rough-and-ready manner. Each existing

block, considered as a single compartment, was divided off, merely for the purposes of examination, into sub-compartments, which were carefully gone over and analysed separately, and a synthesis was then formed of the entire area. Enumeration surveys, including the very same classes as that of the Tháno Forest, were made in sample areas representing the average of the various types, and aggregating from 5 to 30 per cent. and even more of the aggregate area covered by each respective type, according to its absolute or relative importance. Furthermore, the trees for the regular annual fellings of the division were marked by the Working-Plans party for four successive years, and several hundreds of such trees, after being felled, were carefully measured. In addition to these trees, a few sample ones were felled in different places, and the quantity of timber and fuel yielded by them determined. Lastly, coppice improvement operations were made by the same party over two large areas: one near Jhabráwála and the other near Rámgarh, and coppice shoots of known age were measured. The trees in the sample plots set aside for ascertaining the rate of growth of the various species were also measured.

When the above work had been completed, it was proposed to extend the Special Instruction Working Circle, adding to it several more types of forest growth, and thereby permitting of the carrying on, for the benefit of the students, of a larger variety of cultural operations than would otherwise have been possible. Accordingly a complete enumeration survey on the same lines as in Tháno was set on foot in the Khachar, Saura Siroli, Kálimáti and Sirion blocks. This work was in progress, when, at a conference, at which were present the Inspector General of Forests, the Conservators of Forests, Panjab and School Circle, the Superintendent of Working-Plans, the Divisional Officer of the Dún, and the writer, it was decided to give up the idea of a Special Instruction Working Circle treated and managed directly by the School authorities. In consequence of this decision the enumeration survey in progress was continued only until that of the first three blocks was completed, and the Working-Plan which follows embraces the entire area of the reserved forests of the Dehra Dún Division.

The maps that have been used are those on the scale of 4″=1 mile and 1″=1 mile, prepared by the Great Trigonometrical Survey of India from surveys made by the Forest Survey Branch under Captain Bailey and a Great Trigonometrical Survey Party under Captain Thuillier. New roads, division lines, &c., have since been added from surveys made by a special Forest Surveyor, and by students of the Forest School.

The intricate and complicated enumerations described above were undertaken with the intention of fixing the yield in quantity of produce, and applying an area check. But as the work progressed it became more and more evident that the stock was too irregular and in too ruined a condition to bear being treated on any other system than that of mere improvement fellings. Had this been known before, nine-tenths of the field work would have been saved and the preparation of the Working-Plan been rendered a simple matter. Actually the plan has been based exclusively on area, and hence the details of the enumeration surveys, representing an enormous amount of labour, have not been printed here, but deposited in manuscript in the office of the Conservator of Forests, School Circle. Nevertheless these details have not been, nor are, entirely useless. Where complete enumerations have been made, the exact quantity of the present stock is known, and that knowledge cannot but be of great service to the executive officers; while where the system of sample areas was adopted, the results obtained, although doubtlessly somewhat too favourable, will still serve as a useful guide to the local officers; and in either case the figures in question have been utilised by me to check the procedure adopted in the Working-Plan. They should be tested with the figures that will appear in Form 2 of the Departmental Code.

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PART I.

GENERAL DESCRIPTION OF THE FORESTS.

In this description the main facts to be recounted will be grouped under the principal heads as follow:—(i) Those relating to administration; (ii) those influencing production; and (iii) those possessing an economic significance.

CHAPTER I.

FACTS RELATING TO ADMINISTRATION.

Section I.

GENERAL SITUATION, AREAS, AND BOUNDARIES.

The Dehra Dún Forest Division is one of the three Forest Divisions of the School Circle of the North-West Provinces and Oudh, and from being that in which the students of the Forest School receive their practical instruction is also the most important.

Its limits coincide with those of the Civil Sub-Division of the same name, which constitutes the portion, outside the hills, of the Dehra Dún District, Meerut Commissionership. They form, roughly speaking, a long parallelogram stretching north-west and south-east. Two opposite sides of this parallelogram are respectively the Jamna, separating the Civil Sub-Division from the Sirmor State on the north-west, and the Ganges, separating it from British Garhwál and Bijnaur on the south-east; while the main water-parting of the Siwáliks closes it on the side of the Saháranpúr District, and the Mussoorie Range and various streams and other ridges bound it on the side of the Himalayas. The tract is situated between 29°58′ and 30°31′ North Latitude, and 77°37′ and 78°22′ East Longitude, and the total area of the Civil Sub-Division is about 761 square miles. The greatest length along the line of the Siwáliks from the Jamna to the Ganges is 48 miles, while the average width is about 12 miles.

The reserved forests, for which alone the present Working-Plan has been framed, constitute together almost the entire area of the Division, and have been completely demarcated. Their boundaries, where they do not march with those of other reserved forests, are marked with numbered pillars or posts. Where these boundaries are defined by streams or roads, the pillars or posts are put up at the sharper angles, from a few yards to more than a furlong apart. Elsewhere the lines run straight between two consecutive pillars, and are cleared of all woody growth. It is contemplated ultimately to replace all the posts, which stand up out of a cairn of stones, by masonry pillars. Originally the boundaries, even when not following well-defined natural features, consisted of very irregular curves; but in 1871-72 a rectification was effected by means of exchanges with the riverain proprietors, who generally received more land than they gave up. This rectification was effected by the Settlement Department.

On the southern side of the valley the forests form a continuous belt stretching along the slopes of the Siwáliks. On the northern side they form several larger or smaller masses, all but three of them being in the Eastern Dún. The relative situation of the forests, with their areas,* is shown on the attached skeleton map.

* The areas given in the map are in all cases the correct ones, Mr. Reynolds, Superintendent of Forest Surveys, having had them checked at my request I must disclaim all responsibility if the acreages given in the text differ from those of the map. I have already had with infinite trouble to correct all my figures twice, and those now given were furnished to me as authoritative by the Divisional Officer To attempt a third series of corrections now, when the whole working plan is in type and about to be issued from the Press, would require an expenditure of time which I cannot spare and would cause much delay and also inconvenience to the Press. But the discrepancies will not, I think, be numerous or serious.

Section II.

LEGAL POSITION OF THE RESERVED FORESTS.

The reserved forests of this Division are such under Chapter V of the Forest Act of 1878, and this fact is notified in Local Government Gazette, No. 184, dated 27th February 1879. No formal enquiry had been made to settle, once for all, the question of prescriptive rights, and consequently all the forests come under the action of the third clause of Section 34 of the Act, which provides "that if any such rights have not on such date been so enquired into, settled, and recorded, the Local Government shall direct that the same shall be enquired into, settled, and recorded in the manner provided by this Act for reserved * * forests * * *; and until such enquiry, settlement, and record have been completed, no such declaration shall abridge or affect such rights." No such enquiry having yet been made, the matter of the existence or non-existence of rights unfortunately still remains an open question.

Certain concessions have, however, been made by an administrative order in favour of the inhabitants of certain villages. These concessions have reference either to the use of water in streams within reserved forest limits, or to the grazing of a fixed number of cattle at half the rates levied from the general public, or to the removal, under free passes granted, on requisition, by the divisional officer, of headloads of dry fallen wood for fuel for home consumption only. But they exist in respect only of the Nágsidh Forest in the Eastern Dún, and of the entire area, without the Rámpúr Mandi block, in the Western Dún. The administrative arrangement just quoted also provides that not more than half the aggregate extent of these forests shall at any time remain closed against grazing, and that no portion of them shall be so closed except with the assent of the Civil authorities. Lists of the villages or estates enjoying such concessions are given in the special description of the forests thereby affected, and a summary of those concessions is given in the statement below :—

Tract affected by the concession.		Total head of cattle admitted to graze at half rates.				Remarks.
Running No.	Acreage.	Buffaloes.	Cows and bullocks.	Horses, ponies, and donkeys.	Sheep and goats.	
1	4,203	38	485	...	...	The present full annual rates per head of each class of cattle are respectively 4, 2, 1, and ½ annas; hence total money value of concession, at the present rates, — Rs. 1,389-13-6 per annum.
2	2,251	223	1,165	52	175	
3	4,826	106	1,464	33	220	
4	49,220	648	4,323	62	570	
5	16,877	113	1,106	10	...	
Total	77,377	1,128	8,543	157	965	

Section III.

PROTECTION.

These forests are easily protected, as will be observed from the statement of offences recorded in the annual reports.

The present sanctioned establishment consists of—

Permanent.

Rangers	5
Foresters	1
Forest Guards	50

Temporary.

Foresters	4
Forest Guards	18

As far as work and continuous employment is concerned, there is no practical difference between the *permanent* and so-called *temporary* establishments, and there seems no reason why the latter should not be amalgamated with the former, and a non-existing but misleading distinction thereby abolished. The staff of Rangers, in the absence of qualified men, is not yet maintained at its full strength.

The progress of fire conservancy is exhibited in the subjoined statement. The great reduction in the cost per acre actually protected is very striking, and although due in a great measure to improved methods, is also proportionate to the increase of the area under protection. The average area burnt in a single conflagration is only 62 acres, and proves that success in fire-conservancy in the Dún forests is not difficult of attainment.

Statement showing areas, cost, &c., of forests protected from fires in the Dehra Dún Division during the years 1872-86.

Year.	Number of acres attempted.	Number of acres burnt.	Number of fires.	Average number of acres burnt in each fire.	Number of acres actually protected.	Cost.	
						Total.	Per acre actually protected.
							Rs. A. P.
1872-73 ...	306	...	...	...	306	415	0 12 1
1873-74 ...	3,840	...	...	...	3,840	742	0 3 1
1874-75 ...	7,685	...	...	...	7,685	2,112	0 4 5
1875-76 ...	9,055	1,370	5	274	7,685	448	0 0 11
1876-77 ...	13,709	...	...	...	13,709	1,304	0 1 6
1877-78 ...	14,014	...	...	...	14,014	2,004	0 2 4
1878-79 ...	23,236	6,827	7	967	16,409	2,425	0 2 4
1879-80 ...	27,664	58	2	29	27,606	3,535	0 2 1
1880-81 ...	27,664	239	7	34	27,425	3,202	0 1 10
1881-82 ...	37,315	3,653	5	731	33,662	4,613	0 2 2
1882-83 ...	41,027	1,248	4	312	39,779	3,541	0 1 5
1883-84 ...	47,780	149	3	50	47,631	4,664	0 1 7
1884-85 ...	87,321	607	3	202	86,714	5,304	0 0 11
1885-86 ...	127,860	140	6	23	127,720	4,230	0 0 6
	468,476	14,291	42	62	454,185	38,539	0 1 4

CHAPTER II.

CONDITIONS OF PRODUCTION.

In this chapter will be described (1) the topography, (2) the climate, (3) the soil and subsoil, and (4) the crop and its constituent species.

Section I.

TOPOGRAPHY OF THE DÚN.

The Dehra Dún, as its name implies, is a broad, open valley, bounded on the north-east, principally by the first ridge of the Himalayas, and on the south-west by the main ridge of the Siwáliks. The average length and breadth of the valley proper are, respectively, 44 and 12 miles. Although apparently a single valley, it really belongs to two great distinct river systems, those of the Jamna and of the Ganges, which form respectively its northern and southern halves, the waterparting running along the Mohand Pass road up to Májra, and thence in an almost straight line past the Dehra cantonment to Rajpur and on to Landour. The ground falls each way with a nearly uniform gradient of from 34 to 42 feet per mile.

The Jamna portion of the valley is drained by the Asan, which has its sources at Chandarbani just above Májra. Important affluents of this stream, all

of them coming from the Himalayas, are the Tons river, the Suárna Rau, the Chor Khála and the Sítla Rau. The corresponding river on the Ganges side of the Dún is called the Súswa, which is met by the Song, rising 50 miles away in the heart of the Himalayas. Other large streams that unite with the Súswa are the Bindál and Rispana naddis and the Jákhan Rau, all of them also from the Himalayas. The water-courses that come down from the Siwáliks to meet the two main drainage channels are most of them short, shallow mountain torrents, with broad boulder and shingle beds, which are nearly everywhere dry during the greater part of the year, and which, from the débris they bring down and deposit as they flow along, are not unfrequently higher than the surrounding land. This absence of water at the surface is characteristic of all the streams of the Dún, and is due to the great depth of the loose mass of boulders and shingle into which the water sinks, to reappear only where the underlying impermeable band of clay comes up near the surface. Thus even the Súswa and the Song rivers become dry for several miles of their intermediate course (see also Section III, p. 10).

From what has been said above, it will be perceived that the lowest or main drainage line of both the Jamna and Ganges portions of the valley is nearer the Siwáliks than the Himalayas, an obvious result of the much larger mass of débris brought down from the incomparably more extensive drainage areas of the Himalayas. From that drainage line southwards the ground rises nearly everywhere by uniformly easy slopes to within half to two miles of the main ridge of the Siwáliks, when only the gradients become steep. The configuration of the ground within this hilly belt is generally extremely curious. Instead of there being a well-defined main ridge, numerous long and high subordinate ridges run out from the former in every direction, very often suddenly sweeping round and running parallel to it, and by their size obscuring it; so that the chain of the Siwáliks at first sight appears an inextricably confused mass of ridges, spurs, and peaks. This peculiar conformation is most conspicuously developed in the western portion of the range. Even with the good maps extant it is extremely difficult in some places to find the main ridge, and, having once found it, to follow it.

Two large outliers of the Siwálik range require special notice:—(i) The Nágsidh Hill, which lies on the opposite side of the Súswa, and (ii) the Jámankháta Hill, which immediately overhangs the Súswa below its junction with the Song. As in the main chain of the range, the north-easterly slopes rise up by comparatively easy gradients, while the south-westerly slopes are always steep and often precipitous or throw out long spurs.

On the north side of the valley the ground runs up much more rapidly, and, as soon as the foot of the hills is reached, it rises up abruptly from 1,000 to 4,500 feet above it. Moreover, consistently with the height and mass of the ridges and spurs, the valleys are long, deep and winding. Isolated masses here deserving mention are the Ambári, Santaurgarh, Málsi and Nálápani Hills.

Another feature to note in the topography of the valley proper is the great depth and nearly vertical sides of the ravines formed by small, unimportant water-courses. This is due to the rapid fall and the peculiar clayey soil which together produce a heavy scouring action, often resulting in the formation of tunnels at the heads of the ravines. Owing to this peculiar conformation, circulation and export over, in other respects, perfectly flat ground is rendered slow and difficult.

On the west, the Siwálik chain stops abruptly at the gorge through which the Jamna flows, there being no room for even a bridle path along the bank, which is surprisingly low for so large a river. At the eastern extremity, on the other hand, there is a long, flat expanse of land between the hills and the Ganges, containing the fields of several villages and the ancient sacred town of Hardwár. Moreover, the banks of that river stand up there from 30 to 40 feet above the stream.

Section II.

Climate of the Dún.

The climate of such a large tract as the Dehra Dún, with elevations above the sea level varying from 900 feet at Kharkhari to 7,500 feet at Landour, is obviously not a uniform quantity, and it is, therefore, necessary to give here meteorological data collected at more than one point.

The monthly mean temperatures at the undermentioned places have been as follow:—

Place.	Elevation above sea level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.	Number of years from which the mean has been deduced.
Landour ...	7,500	37 8	44·1	49·1	56 3	63·2	68 5	65·3	63·9	64·3	56·4	49·4	44·1	55·2	4·5
Mussoorie (1) ...	6,940	41·7	44·2	51·7	59·8	65·6	68·5	64·7	64·1	63 6	57·3	52·0	48·0	56·6	3·14
Mussoorie (2) ...	5,858	45·6	47·0	57·2	63·5	67 0	70·8	66·4	65·3	63·2	63·0	56 6	47 6	59·6	1·3
Dehra ...	2,230	53·3	58 2	66·4	75·9	82·1	84·7	80·1	78 8	77·6	70 8	62·2	56·1	70·7	18·20
Kálsi ...	1,800	58·3	61·6	62·6	77 7	81·2	86 0	83·7	80·2	77·2	70 8	63·2	59·7	71 8	1·2
Rúrki ...	887	55·7	60·3	68 7	80 7	87 3	90·4	84·9	83·4	82·4	74·2	63·4	56·2	74·0	19

With the help of the preceding figures and of the table given by Mr. Blanford on page 135, Volume II, Part II of the Indian Meteorological Memoirs, and partly also by the interpolation of purely arithmetical means, as the figures in the table in question frequently gave inconsistent results, monthly and annual mean temperatures have been calculated for the following series of elevations above sea level, which comprise the entire range of altitude within which all the forests provided for by this Working-Plan are situated:—

Elevation above sea level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1,000 ...	57°·5	60°·9	68°·8	79°·4	87°·0	89°·2	84°·6	83°·3	82°·7	73°·8	63°·7	58°·4	74°·6
1,500 ...	56°·6	59°·8	67°·9	78 ·3	85°·1	87°·5	82°·9	81°·6	80°·2	73°·1	63°·2	57°·5	73°·1
2,000 ...	55°·6	58°·6	66°·9	76°·8	83°·2	85°·8	81°·2	79°·9	78°·6	71 ·3	62 ·7	56°·5	71°·5
2,500 ...	54°·5	57°·3	65°·9	75°·3	81°·2	84°·0	79°·4	78°·1	77°·0	70°·5	62 ·1	55°·5	69°·9
3,000 ...	53°·4	55°·9	64°·8	73°·7	79°·2	82°·2	77 6	76°·3	75°·3	69°·6	61°·5	54°·4	68°·2
3,500 ...	52°·2	54°·4	62·6	71°·9	77°·1	80°·3	75°·7	74°·4	73°·6	68°·6	60 ·8	53°·3	66°·5
4,000 ...	50°·6	52°·8	62°·4	70°·1	74°·8	78 ·2	73°·7	72°·4	71°·8	67°·5	60°·1	52°·2	65°·7
4,500 ...	49°·1	51°·1	61°·1	68°·2	74°·4	76°·1	71°·6	70°·3	69°·8	66°·4	59°·3	50°·8	63°·9
5,000 ...	47°·5	49°·3	59°·6	66°·1	69°·7	73°·7	69°·3	68°·0	67°·6	65°·1	58°·4	49°·3	61°·9

The shade maximum and minimum temperatures at the Lower Mussoorie Station, at Dehra and at Rúrki, may register the following extreme figures:—

Station.	Maxima.				Minima.						
	March.	April.	May.	June.	October.	November.	December.	January.	February.	March.	April.
Mussoorie (2) ...	89°	97°	88°	86°	48°	41°	41°	31°	32°	40°	46°
Dehra ...	92°	98°	102°	101°	49°	39°	36°	34°	34°	40°	46°
Rúrki ...	98°	108°	113°	112°	51°	42°	39°	37°	38°	44°	55°

The monthly mean excess temperature of the solar thermometer above the maximum in shade at the stations of Dehra and Rúrki have been :—

	Dehra. (54·9 years.)	Rúrki. (3·4 years.)
January	51·0°	56·5°
February	52·2°	59·5°
March	57·6°	57·9°
April	57·1°	57·4°
May	56·8°	55·0°
June	54·2°	54·2°
July	53·6°	58·8°
August	52·1°	58·9°
September	57·7°	58·4°
October	58 5°	57·5°
November	55·6°	57·5°
December	51·8°	56·4°
For the year	54 9°	57·3°

During the five undermentioned months, which are the most trying of all to tree-vegetation, especially in the case of species that, like sal, put forth their new foliage in spring, the solar thermometer may register the following high figures :—

Places.	Nature of reading.	March.	April.	May.	June.	October.
Dehra	Maximum Temperature	153°	158°	158°	166°	152°
	Maximum Difference	64°	73°	69°	67°	67°
Rúrki	Maximum Temperature	159°	167°	169°	167°	155°
	Maximum Difference	68°	70°	66°	72°	61°

The monthly mean depression of the grass thermometer below the minimum in shade at the same two stations has been :—

	Dehra. (3·8 years.)	Rúrki. (5·6 years.)
January	4·4°	7·1°
February	4·4°	6·7°
March	4·2°	7·0°
April	4·7°	7·6°
May	4·8°	5·5°
June	3·6°	3·2°
July	2·2°	1·9°
August	1·5°	2·3°
September	2·3°	3·9°
October	3·5°	6·8°
November	4·8°	7·9°
December	4·6°	7·3°
For the year	3·8°	5·6°

The grass thermometer at the same stations may mark the following figures during the months named, which are the most critical for young growth and for new shoots situated less than 20 feet above the ground :—

Places.	Nature of reading.	October.	November.	December.	January.	February.	March.	April.
Dehra	Minimum temperature	45°	34°	32°	29°	25°	37°	43°
	Maximum depression	13°	14°	14°	9°	12°	10°	11°
Rúrki	Minimum temperature	43°	31°	29°	27°	27°	33°	44°
	Maximum depression	10°	11°	12°	12°	13°	17°	15°

There are many places in the Dún, especially in the low grass lands within two miles on each side of the Súswa, Song, Asan, and Tons, where the night temperatures during October-April are several degrees below those at Dehra; and it must be remembered that the meteorological observatory at that town is situated in the neighbourhood of a shady grove of large trees. Frost has been frequently observed in those places as early as the first week in November.

The mean diurnal and annual ranges of temperature in the shade at the station of Dehra during 30-2 years have been:—

January	23·4°
February	23·1°
March	24·0°
April	26·3°
May	24·1°
June	18·3°
July	12·8°
August	12 5°
September	15·0°
October	23·4°
November	25·9°
December	24·3°
For the year	21·2°

The corresponding figures for other localities in the Dún will obviously be higher or lower according as their elevation above the sea is less or greater than that of Dehra. Moreover, the absolute range even for Dehra may go up to over 40° just before the rains close, so that out on open land the absolute range may, from some time before the close of the rains to the middle of the following spring, occasionally reach the extreme figure of 120° and upwards, a range which, it is evident, must be extremely trying to the young, imperfectly lignified shoots of saplings and low poles.

The monthly mean tension of aqueous vapour at the station of Dehra has during 12-13 years been:—

January	0·294
February	0·325
March	0·372
April	0·418
May	0·511
June	0·721
July	0·881
August	0·878
September	0·794
October	0·521
November	0·356
December	0·301

The mean relative humidity, computed from the minima temperatures observed at the Forest School during the past four years, has been:—

January	93
February	91
March	86
April	69
May	73
June	84
July	94
August	95
September	94
October	87
November	87
December	88

Nightly dews prevail uninterruptedly throughout the year, with the exception of April, May, and part of June; but in occasional years there are very few nights, even during those months, without dew.

The average proportion of clouded sky, in tenths of the expanse, at the station of Dehra during 11-12 years has been:—

January	3·57
February	4·23
March	3·46
April	2·89
May	3·03
June	4·42
July	7·74
August	7·40
September	4·68
October	1·98
November	1·10
December	2·50

The average monthly and annual rainfall of the following stations has been:—

Station.	No. of years yielding average.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Mussoorie .	18-30	2·08	3·21	2·98	1·86	2·60	9·86	30·47	30·21	9·97	1·00	0·15	1·69	95·48
Dehra .	34-36	1·97	1·93	1·82	0·71	1·42	8·17	24·45	22·88	8·99	0·71	0·11	0·49	73·15
Bhogpúr .	4	2·12	0·67	1·62	0·40	1·72	9·50	28·30	28·02	16·25	0·37	0·25	...	89·22
Harbanswálá .	10	?	?	?	?	?	?	?	?	?	?	?	?	63·09
East Hopetown	8-9	2·34	1·79	1·34	0·65	2·30	6·30	17·63	15·51	7·87	0·33	0·69	0·86	57·45
Máyápúr .	8-9	2·16	1·21	0·81	0·08	0·89	3·57	13·65	13·10	8·59	0·94	0·22	0·27	41·29
Ambári .	4	2·25	1·05	1·62	0·32	1·07	6·45	21·57	18·70	9·42	0·67	0·52	...	63·64

The summer rains begin about the middle of June and continue till the middle of September, but the heaviest fall is in July and August. Occasional showers invariably occur during the latter part of September and the first half of October. After this there may be no rain till the middle or end of December, and usually this period is marked by clear, cloudless skies. Heavy showers, continuing for two or three days with few or no breaks, always fall some time in January and the early part of February. Thenceforward, until the commencement of the regular summer rains, there may be no precipitation at all; but it is more common to have occasional short, sudden showers, accompanied with thunderstorms, during every month of this period, especially March and May.

Observations taken at the Forest School and at Rámgarh, both inside and outside the forests, and in sheds placed at the ordinary height, and at 66 feet above the ground respectively, furnish comparative results of very great value. The following figures give the annual mean difference between readings taken at the upper and lower observatories, the signs + and − being used to denote excess or defect of the former:—

	Mean.
Minimum air temperature in shade	+2·2
Maximum " " " "	−2·6
Daily range of " " "	−4·8
Tension of aqueous vapour	−0·048
Relative humidity	−8
Rainfall	+1·17

The mean direction and movement of winds at the station of Dehra have been :—

	Average resultant. (10-15 years.)	Average diurnal velocity in miles. (5-7 years.)
January	S. 68° W. ...	46·0
February	S. 85° W. ...	51·5
March	N. 78° W. ...	56·1
April	N. 79° W. ...	64·9
May	S. 66° W. ...	59·9
June	S. 71° W. ...	36·1
July	S. 37° W. ...	29·9
August	S 43° W. ...	26·4
September	N. 80° W. ...	27·9
October	N. 38° W. ...	38·7
November	N. 76° W. ...	45·7
December	S. 82° W. ...	45·4

The direction and movement of winds at the station of Mussoorie have been observed for only six months in the year, during the residence of the Great Trigonometrical Survey Officers there. For those months they are as follows :—

	Average resultant. (4-5 years.)	Average diurnal velocity in miles. (For 5 years)
May	S. 12° E. ...	303·8
June	S. 4° W. ...	271·5
July	S. 6° E. ...	220·2
August	S. 25° E. ...	206·5
September	S. 30° E. ...	202·5
October	S. 49° E. ...	213·9

A comparison of the figures given above of the mean velocity of the wind brings into prominence the great protection afforded to the immediate valley and its northern slopes by the chain of the Siwáliks. The only portion of the Dún exposed to winds really injurious to forest vegetation are the higher ridges of the Siwáliks, the slopes at the two extremities of that chain, and the sides of the Himalayas above 3,500 feet, which elevation is exceeded by scarcely any portion of the Reserved Forests of this Division, and by none that is of any value in respect of production.

In the last place, a few brief remarks seem called for regarding the effect of the climate on the health of man, as on this necessarily depends the distribution of the establishment and work throughout the course of the year. On the whole, the climate of the Dún is salubrious, and is one of the best in India. As a rule, the interior and immediate vicinity of sal forest, the presence of which bespeaks good drainage, are perfectly healthy throughout the year; so are all places from 2,800 feet above the sea upwards. Below this elevation two main factors determine whether a given place is healthy or not, *viz.*, (i) swampiness, and (ii) rank growth of grass. The swamps, which occur cheifly in the Eastern Dún, are quite independent of the presence or absence of forest, and, as shewn in Section III, p. 10, are the inevitable result of the geological formation; they can be got rid of only by special drainage works. A rank growth of grass occurs wherever the land is quite bare of forest growth or has only a very open scrub on it, and the soil, from being close to low drainage lines, as on the banks of the Ganges, along the Súswa, &c., remains very moist close or right up to the surface. The presence of a well-grown forest dissipates the excess moisture through the millions of stomata of the leaves and keeps the soil cool—both circumstances unfavourable to the production of malarial spores. Continuous cultivation, by opening out the interior soil and exposing it to the action of the sun and the crops, has the same effect, although during the first two or three years of the cultivation, until the cumulative effect of this joint action has reached the desired point, the climate may become

very deadly. Take, for instance, Mr. Lister's Májri grant. Four years ago it was chiefly grass land bearing a little low scrub, and, lying as it does on the low land between the Song and the Jákhan, where these rivers approach one another, it was one of the most unhealthy even in the Eastern Dún. During the first year of cultivation several men died, during the second year the number of casualties diminished very considerably, and now, at the end of only five years, the place is by no means among the least unhealthy in the Eastern Dún, and even Europeans consider it healthy enough to live there during the worst season of the year.

For the reasons just given, the heavy water-logged grass lands from Bulláwala to Kánsrau are extremely unhealthy during the rains and at the end of the hot weather and the beginning of the cold weather; and whatever work has to be done there should be undertaken outside those seasons, the establishments stationed there being removed to healthier localities during the rains.

Section III.

Rocks and Soils in the Dún.

As regards its rocks and soil the Dún may be considered to consist of three belts: (i) the Himalayan belt, composing the hills that bound the valley proper on the north—the southern face of the valley; (ii) the boulder belt, occupying all the flat or gently sloping land between (i) and (ii) *i.e.*, the valley proper; and (iii), the Siwálik belt, forming the entire chain of the Siwáliks which closes the valley on the south.

The first belt is not of much consequence for the present Working-Plan, as it contains only a small unimportant area of about 9,000 acres out of a total of more than 177,000 acres of Reserved Forests. Although termed here the Himalayan belt on account of its forming orographically a part of the chain of the Himalayas, still the portion of it in the Western Dún belongs to the Náhan formation of the Sub-Himalayan series. It consists principally of loose sandstones which, even where there is no soil, give a good foothold to trees. The portion of this belt in the Eastern Dún, which is of true Himalayan formation, consists of quartzite, schists and slates, with a little limestone. The last rock is found principally at the head of the Bidhalna Rau and in a small hill above the Chandanáwa Rau, and is strongly dolomitic. In the Western Dún, the Ambári hill consists chiefly of sandstones containing in a few places small deposits of lignite. In this belt the soil, wherever it has a chance of accumulating, is extremely well suited for forest growth. Indeed most of the excellent soil in the portion of the valley proper, north of the Dehra-Hardwár road, is the direct result of the disintegration of the rocks here.

In the valley proper, if the shingly beds of the streams and Siwálik outliers be excepted, there is soil everywhere, of various depths and richness, overlying, save at the foot of the hills, boulder and shingle beds. These beds are of great thickness, the thickness, of course, increasing with increasing distance from the hills and being greatest on the Himalayan side of the valley. It is for this reason that the permanent level of water is at such a great depth, the well at the cutcherry at Dehra being 228 feet deep. Frequently, interbedded with these deposits, are found thin bands of clay. In the Eastern Dún, on the north side of the valley, one such band extends from the Himalayas right down to the lowest point of the valley. After it leaves the foot of the hills it dips deeper and deeper into the boulder bed, but ultimately crops out near the edges of plateaux, where, if the fall of the ground is insufficient, the abundance of water that wells up at the surface produces swamps, as near Banjáráwála, Nakraunda, Jogiwála and Khairi. Sometimes the clay band attains a considerable thickness, and affects, unfavourably for tree growth, the soil near and over it, as near Lachhiwála, on the plateau between the lower course of the Song and the foot of the Himalayas, on the plateau north of Jhájrá, &c.

A rough analysis of an exaggerated description of soil in contact with this clay, taken from near the Palási Tappar, yielded the following results :—

(1) Organic matter and iron 4 and 3·5 per cent. respectively.

(2) Proportion of clay to silicious sand as 51 : 49.

(3) 1,000 grains of the soil thoroughly dried and exposed to the air in a room absorbed in 24 hours nearly 3 per cent. of its own weight of moisture (February).

(4) Saturated, this soil held 40 per cent. of its own weight of water, while pure sand held only 22·7 per cent. of its own weight, the respective hygroscopicities being in the ratio of 40 : 23.

(5) The two saturated samples of the soil and of pure sand, weighing respectively 1,400 and 1,227 grains, were exposed to the air in the laboratory, and lost in 24 hours 153 and 191 grains respectively, the relative rapidity of drying of the two samples being roughly as 15 : 19.

(6) Air-dried samples of the soil and of the pure sand were exposed to the sun in February during three hours, from 11 a.m. to 2 p.m., the temperature of solar radiation being 56° C. The temperature of the soil rose from 13°·5 C. to 30°·5 C, while the sand rose from 13°·8 C. to 36° C.

Lastly, the Siwálik belt consists exclusively of the well-known formation of that name. It is entirely of alluvial origin, being formed from the disintegrated rocks of the higher neighbouring range. It consists of sandstones and conglomerates of all degrees of hardness, but more often soft and frequently extremely friable. The sandstones are seldom fit for building purposes, but one very excellent building stone is found near Kharkari at the extreme easterly end of the belt. The conglomerates consist of pebbles of generally very hard rocks, quartzite or a fine-grained semi-crystalline sandstone, in a highly calcareous matrix. Interbedded with these sandstones and conglomerates are bands of clay, nearly always strongly ferruginous, often shaly, but nowhere passing into true slates. Frequently these bands are quite earthy and a little weathering suffices to convert them into soil. Owing to the presence of these bands of clay, the soil formed from the sandstones and conglomerates is never wanting in cohesion, and, when deep enough and situated on a good subsoil, is excellent for sal. Sometimes, however, the proportion of clay is excessive for that tree, and then only sain and some inferior species can prosper on it. There is no truly limestone rock in the Siwálik belt, and even the conglomerates contain so few pebbles of limestone, that the raus that take their rise here cannot be profitably exploited by the lime-burner; but the quantity is nevertheless sufficient to impart favourable qualities to the soil.

In conclusion, considering the Dún as a whole, it may be said that, although the soil itself is not unfavourable for the prosperous vegetation of sal, the subsoil, without affecting injuriously either its reproduction or its proportion in the forest, will never allow that tree to attain more than merely moderate dimensions (a height of 90 feet with an average girth of about 5 feet 6 inches) and a very slow rate of growth. The nature of the subsoil outside the hilly belts may be easily judged from a glance at Appendix I.

Section IV.

THE STOCK.

The stock may be divided into eight main types as follows:

1. *Sal with its usual companions.*—Mostly all the plateau land and low slopes.

2. *Sain pure.*—Patches of very stiff soil, especially near ravines.

3. *Sissu and Khair.*—Principally islands and banks of rivers.

4. *Mixed Chir.*—Small strips and patches along the principal ridges of the Siwáliks.

5. *Bamboos.*—In patches in ravines and at the foot of slopes, and spread out extensively on the steeper drier slopes.

6. *Miscellaneous trees attaining the size necessary for timber.*—Generally in low-lying places and on the steeper slopes with favourable soil.

7. *Scrub, composed principally of inferior species.*—All very dry and rough slopes and ridges and on stiff ferruginous clays.

8. *Open thorny scrub.*—Patches of good soil, long under cultivation, which have been recently abandoned.

The first main type may itself be divided into four principal subordinate types, according as (*a*) the sal is more or less pure, or (*b*) it is mixed with a notable proportion of sain, or (*c*) sain is quite or nearly absent, and there is a large proportion of inferior timber trees attaining the same height as sal, or (*d*) the companion species, always very abundant, are small timber trees or large shrubs. All these four varieties are so extensively distributed in the Dún that they each require detailed consideration as separate types. The third main type also consists of three well marked varieties according to the proportion of each of the two principal component species. The fifth main type also separates itself into two varieties according to the proportion of bamboo.

We have thus the fourteen following well marked types:

		Acres.
A.	Sal, covering an aggregate of	56,953
B.	Mixed sal with sain	22,887
C.	Mixed sal without sain, but with inferior timber trees ...	29,282
D.	Mixed sal with inferior species alone	8,613
E.	Sain ... ... (area lumped up with that under B) ...	
F.	Sissu	1,134
G.	Khair	1,608
H.	Mixed sissu and khair	4,459
I.	Mixed chir	94
K.	Pure bamboos ... (area lumped up with that under L) ...	
L.	Mixed bamboos	4,124
M.	Miscellaneous timber trees	9,996
N.	Scrub	13,438
O.	Open thorny scrub	764
To these may be added—		
P.	Grassy blanks	8,520
Q.	Unproductive areas	15,186
		177,058

The present stock consists of the ruins of the good original forest of former times (see Appendix II), with the young growth that has been coming up since the beginning of conservation in 1864.

A.—More or less pure sal.

The aggregate area covered by this type is 56,953 acres, or nearly one-third of the entire area of the Reserved Forests. Strongly ferruginous clayey soils or a water-logged subsoil excepted, it is spread over all the plateau land and easy slopes not exceeding a gradient of 15°, where a certain amount of good soil can accumulate. It contains from 20 to 40 per cent. of other trees, at least half of them belonging to species too small to be able to compete in a permanent manner with the sal, and form with it an integral part of the leaf-canopy. In spite of this unquestionably large admixture, the first impression to a casual observer is that of a perfectly pure sal forest, and it is only after a further attentive regard that the presence of other species is noticeable. There is still another and stronger reason for considering this the special sal type. As, until recently, sal was almost the only tree cut, its proportion in the young crop now coming on is much larger than that in the upper story, so that the forest growth will ultimately contain very much more sal than it does at present.

The upper crop now consists of a disproportionately small number of trees above four feet six inches in girth, and even the majority of these are unsound; the larger sound trees having been cut away before. This upper crop is thus composed principally of poles of all sizes, the majority of which, in the complete absence of any conservancy, have grown up under constantly adverse conditions,

and are in consequence knotty, undersized, and of only moderate vigour. Even the larger saplings are, on this account, deformed, and, for the most part, making very little growth. The most frequent companion of the sal in this type is *Lagerstrœmia*, which, although tall enough to always form a part of the leaf canopy, never attains the same height as sal. Other constant companions of sal here are bhiláwa, bahera, piáman, *Ehretia laevis*, *Bauhinia variegata* and *malabarica*, jáman, *Grewia asiatica* and *Casearia tomentosa*. In this type the most frequent shrub is *Randia dumetorum*.

The following statement is an estimate of the stock contained in this type :—

Species.	Girth above							Total number of trees of all size-classes.
	9″	1′6″	3′	4′6″		6′		
	And up to							
	1′6″	3′	4′6″	6′				
				Sound	Unsound	Sound.	Unsound	
Sal	4,456,638	2,235 207	495,596	53,128	18,851	6,400	6,586	7,272,406
Sain	54,440	39,063	12,652	4,410	1,563	885	534	113,557
Siasu	7	19	6	6	...	...	...	38
Chir	495	575	429	161	...	87	...	1,747
Khair	...	...	...	...	...	...	...	...
Miscellaneous timber trees	934,324	455,170	106,730	17,600	5,860	6,010	6,345	1,532,039
Inferior trees and large shrubs	555,851	187,908	24,158	3,293	...	...	...	771,210
Bamboo clumps	...	...	...	...	...	...	...	185

B.—Mixed sal with sain.

This type is not so continuously spread as the preceding, but is distributed in patches or belts of various sizes wherever on the plateaux, in the neighbourhood of the preceding type, the soil or subsoil become strongly clayey, or where near the ravines the ground becomes markedly moist, or, where on the broken protected lower slopes, chiefly of the Siwáliks, subterranean moisture is not far from the surface. One at least of these three conditions is necessary for the presence of sain in any conspicuous numbers in the midst of sal. The aggregate area covered by the type is about 22,887 acres, or a little more than one-eighth of the area of the Reserved Forests of the Dún. Where the soil and subsoil are not too strongly clayey, there this type produces a very fine forest, the sain with its mostly horizontal ramification of roots utilising to the full the portions of the soil left by the sal, and, by means of its broader, but, for the sal, not invasive crown, closing up effectually the gaps between the long cylindrical or conical crown of its more valuable companion, which then, as a necessary result, gets drawn up and loses its tendency, so conspicuous in the Dún, of forming an irregular-shaped, knotty bole. The minimum proportion of sain in this type is about 10 per cent., which secures for that species sufficient possession of the soil to perpetuate the type, and, since the sain is a larger and faster growing tree, very materially increases the yield of the crop. The other companions of sal are the same as those in the first type, but *Buchanania latifolia* begins here to be conspicuous. The reproduction in this type is very variable. In some places the advance growth contains a very much larger proportion of sain than does the upper crop and *vice versâ*, the former contingency being more frequent. For instance, in the Lachhiwála block of the Nágsidh forest, west of the Hardwár road, owing to the strongly clayey nature of the soil and subsoil, and the hardening of the surface by heavy grazing, sain is becoming rapidly the predominant tree. Not uncommonly in such soils, owing to the sal being unable to contribute its proper share in the renewal of the forest, the reproduction is on the whole very backward. As the sain was not often felled under the pre-departmental *régime*, the proportion of large and sound trees of that species is, relatively to its number in the crop, much larger than that of

sal. The subjoined statement contains an estimate of the stock under this type :—

Species.	Girth above							Total number of trees of all size-classes.
	9"	1'6"	3'	4'6"		6'		
	And up to							
	1'6"	3'	4'6"	6'				
				Sound.	Unsound.	Sound.	Unsound.	
Sal	652,475	492,573	174,167	26,260	8,694	2,515	2,412	1,358,093
Sain	103,588	135,694	46,386	9,217	839	564	1,684	297,372
Sissu	...	...	...	...	...	...	...	...
Chir	195	260	618	42	...	...	...	1,115
Khair	...	...	...	...	...	...	...	...
Miscellaneous timber trees	456,350	309,819	35,311	6,352	1,229	2,948	991	812,900
Inferior trees and large shrubs	1,025,735	99,553	8,283	1,639	...	...	...	1,135,210
Bamboo clumps	...	...	...	...	...	...	...	458

C.—Mixed sal without sain, but with inferior timber trees.

This type, which altogether covers 29,282 acres or one-sixth of the total area of the Dún Reserved Forests, is the same as the preceding without the marked proportion of sain and with very much more numerous *Buchanania* and sándhan, and its differentiation from that type is due simply to a change in the tenacity and humidity of the soil. It is found mainly on the lower slopes which are too dry or too exposed for sain to occur in any conspicuous numbers, and also in small patches on flat, low ground where frosts, combined with the extreme moisture of the soil, keeps out sain. Owing to the less favourable conditions under which the type occurs, it is obvious that the stock in it is by no means so good as in the two preceding. Not only is the growth generally more open, but the trees, especially the sal, do not attain the same height or produce as long, well-shaped, thick, or sound boles as they do there. As regards the reproduction, the proportion of sal in the advance growth is very variable. Wherever the slopes are not too steep, and the surface is rough, there young sal is extremely abundant, while on flat smooth ground reproduction of that species is very backward. This is also the case on very dry exposed slopes, as on the western face of the Ambári Hill. On such slopes climbers are extremely abundant and destructive, and their seedlings often form the greater portion of the advance growth. This preponderance of climber seedlings is also often characteristic of flat ground with a hard surface, as in many parts of the Nágsidh Forest. Subjoined is an estimate of the quantity of stock standing in this type :—

Species.	Girth above							Total number of trees of all size-classes.
	9"	1'6"	3'	4'6"		6'		
	And up to							
	1'6"	3'	4'6"	6				
				Sound.	Unsound.	Sound.	Unsound	
Sal	1,149,334	1,063,248	166,423	16,173	3,322	2,928	2,486	2,403,864
Sain	18,812	33,032	7,506	2,172	182	910	158	62,772
Sissu	...	...	...	...	...	...	...	...
Chir	902	3,636	2,734	767	87	83	25	8,264
Khair	342	124	...	...	...	...	...	466
Miscellaneous timber trees	900,380	790,140	84,069	12,312	4,585	4,778	4,899	1,801,163
Inferior trees and large shrubs	442,759	213,911	11,594	908	...	...	...	677,572
Bamboo clumps	...	...	...	...	...	...	...	334,150

D.—Mixed sal with inferior species alone.

This type is really a degenerate form of the preceding, the result of sal spreading out over the worst ground it can exist on. Hence, going up towards the main ridge of the Siwáliks, it generally forms the fringe of the great sal belt which stretches from the Jamna to the Ganges, being discontinuous only where, good soil and fairly easy slopes occurring, the immediately preceding type extends right up to the watershed line itself, or where there is no gradual alteration of the conditions of vegetation, but both soil and gradient undergo an abrupt change which the sal forest cannot follow. For the purposes of this Working-Plan, wherever bamboo enters this type, the area producing that valuable species has been put under a separate type. It being already stated that the type under description is a degenerate form of C, it is easy to understand that, as a rule, the stock is much more open and lower than in any of the preceding types ; that sal is less at home, although it may often be very abundant; and that in the hilly portions, to which moreover this type is principally confined, the proportion of sándhan, *Buchanania*, and *Randia dumetorum,* as also that of climbers, becomes very large. An instance of a wide stretch of this type on flat, comparatively low ground is the greater portion of the Chándpúr Forest, which is the only area under it that is growing under good natural conditions and is, therefore, very little, if at all, inferior to the average specimens of type C. There all the natural conditions are favourable for the growth of an inferior form of type A, but continued reckless over-cutting and heavy grazing have reduced the forest to the present type. It is a noteworthy fact that out of an aggregate area of 8,613 acres under this type, 7,627 or 88 per cent. of the whole, is distributed in the Western Dún, and most of this occurs in the western portion of that section. This fact is easily accounted for by the much drier climate of that tract. The total quantity of stock in this type has been calculated as under :—

Species.	Girth above							Total number of trees of all size-classes.
	9"	1'6"	3'	4'6"		6'		
	And up to							
	1'6"	3'	4'6"	6'				
				Sound.	Unsound.	Sound.	Unsound.	
Sal	249,980	212,413	72,759	5,366	4,739	491	1,143	546,891
Sain	9,577	8,898	3,317	909	313	90	48	23,352
Sissu	133	30	8	...	...	...	...	171
Chir	115	146	87	...	...	...	...	348
Khair	290	101	...	...	...	...	...	391
Miscellaneous timber trees	120,475	78,389	15,341	1,824	1,428	252	610	218,219
Inferior trees and large shrubs	223,262	91,713	29,029	1,318	...	...	...	345,385
Bamboo clumps	...	...	...	...	...	...	...	69

E.—Sain more or less pure.

The type is of very limited distribution, occurring generally in very small, insignificant patches, one of the largest being a narrow strip of about 4 acres in the Dhaulkot Forest on the edge of the plateau north-east of Jhájra. On this account it has been found impossible in most cases to show them on the maps, and for the purposes of this Working-Plan they have been lumped up with type C.

F.—Sissu more or less pure.

This type is confined to the islands and low banks of the larger streams, wherever there has been or is a tendency. to the formation of deposits of silt. Thus in the Tons and in the Asan, which contain scarcely any islands, sissu is almost entirely absent, and on this account the islands in the Jamna, which could be sown only from seeds washed down by its affluents from the interior, contain

in the Dún at least, next to no sissu. On the other hand, all the streams of the Eastern Dún wander over a great width, dividing into arms which encircle islands of silt and thus afford a habitat for that species.

To illustrate the preceding statements with figures, there is only one acre under this type in the Western Dún, and that on a small island below the confluence of the Ásan with that river; while in the Eastern Dún there are no less than 1,133 acres so stocked, this area being distributed chiefly between the Súswa and Song and the Jákhan Rau. The total quantity of stock estimated to stand in this type is as follows:—

Species.	Girth above							Total number of trees of all size-classes.
	9"	1'6"	3'	4'6"		6'		
	And up to							
	1'6"	3'	4'6"	6'				
				Sound.	Unsound.	Sound.	Unsound.	
Sal	...	...	...	...	...	...	...	...
Sain	...	...	...	...	...	...	...	.
Sissu	13,368	21,866	4,379	476	40	33	7	40,169
Chir	...	...	...	...	...	...	...	...
Khair	933	738	22	...	...	...	...	1,693
Miscellaneous timber trees	1,356	1,099	147	46	10	8	4	2,670
Inferior trees and large shrubs	1,504	464	41	3	...	...	...	2,012
Bamboo clumps	...	...	...	..	...	.	...	...

G.—Khair more or less pure.

This type affects the same localities as the preceding, but, owing to the khair being able to reproduce itself even on perfectly consolidated silt in the midst of grass, it is more widely distributed. Thus in the Western Dún, in the Jamna, there are 28 acres under this type, and in the Eastern Dún, mainly in the same localities as the preceding type, it is spread over an aggregate area of 1,608 acres. The stock included in this type is estimated to contain the following number of trees:—

Species.	Girth above							Total number of trees of all size-classes.
	9"	1'6"	3'	4'6"		6'		
	And up to							
	1' 6"	3'	4' 6"	6'				
				Sound	Unsound.	Sound.	Unsound.	
Sal	299	338	104	...	...	...	...	741
Sain	5	10	10	20	...	5	...	50
Sissu	1,555	2,327	503	35	...	22	...	4,444
Chir	...	..	...	...	...	...	...	...
Khair	103,713	49,848	2,128	172	...	...	...	154,861
Miscellaneous timber trees	5,102	7,997	3,433	979	59	273	5	17,848
Inferior trees and large shrubs	2,612	1,610	280	32	.	.	...	5,634

H.—Mixed sissu and khair.

This type obviously interlaces with and runs in between the two preceding, due, as it is, to their overlapping. As khair propagates itself freely almost anywhere, and little patches here and there throughout the river areas are suitable for sissu, the aggregate area the two species occupy jointly is very much larger than what they cover separately, being 4,459 acres, or about 60 per cent.

more than the combined areas under the two preceding types. The following statement contains an estimate of the stock under this type :—

Species.	Girth above 9″ and up to 1′ 6″	Girth above 1′ 6″ and up to 3′	Girth above 3′ and up to 4′ 6″	Girth above 4′ 6″ and up to 6′ Sound.	Girth above 4′ 6″ and up to 6′ Unsound.	Girth above 6′ Sound.	Girth above 6′ Unsound.	Total number of trees of all size-classes.
Sal	152	231	...	...	...	...	...	383
Sain	237	...	...	...	...	...	...	237
Sissu	57,179	72,780	7,573	320	22	22	8	137,853
Chir	...	...	...	...	...	...	...	...
Khair	93,088	147,638	2,755	123	...	...	...	243,578
Miscellaneous timber trees	26,713	50,406	8,486	2,600	278	677	151	88,311
Inferior trees and large shrubs	34,871	12,008	303	67	...	...	...	47,249

I.—Mixed chir.

Although chir is found almost along the entire line of the main ridge of the Siwáliks, still the large amount of clay in that range and the cool northerly aspect on the Dún side prevent that species from assuming its general gregarious character, and accordingly it is only here and there that it occurs in sufficient numbers to constitute a separate type. As the ground on which it is distributed is extremely rugged, to have searched out and located on the map every little patch of it along the entire 48 miles length of the chain, would have required an amount of labour totally incommensurate with the relative value of the type. Hence, although only 94 acres have been actually put down on the maps as under the type, the real aggregate area is probably double, or about 200 acres. And accordingly the following estimate of the standing stock in it is somewhat under the mark :—

Species.	Girth above 9″ and up to 1′ 6″	Girth above 1′ 6″ and up to 3′	Girth above 3′ and up to 4′ 6″	Girth above 4′ 6″ and up to 6′ Sound.	Girth above 4′ 6″ and up to 6′ Unsound.	Girth above 6′ Sound.	Girth above 6′ Unsound.	Total number of trees of all size-classes.
Sal	...	...	...	...	...	...	...	...
Sain	100	140	56	32	...	4	...	314
Sissu	...	...	...	...	...	...	...	...
Chir	425	860	269	32	...	...	...	1,585
Khair	...	...	...	...	...	...	...	...
Miscellaneous timber trees	130	468	26	...	...	...	...	624
Inferior trees and large shrubs	468	364	...	...	...	...	...	832
Bamboo clumps	...	...	...	...	...	...	...	...

K.—Pure bamboos.

This type is of extremely slight development, being spread over a much less length than chir; and as it does not occupy in any one place a larger area than a few acres, it was considered a work of supererogation to mark each little spot on the map, and the acreage under it has therefore been lumped up with that of the next one.

L.—Mixed bamboos.

This type occurs in only one instance on flat ground, and that is on both sides of the Hardwár road near Pardúni, where it covers an area of about 400

acres; but even here the ground is stony and the rock not far from the surface. Everywhere else it is met with on slopes and in well-drained ravines where the mean temperature of the air is sufficiently high. Hence it is found mostly on the warm slopes above the Ganges. Out of a total area of 4,124 acres occupied by the type, 3,685, or about 85 per cent., are confined to that limited tract. Two other places where it has any considerable development are—

(*i*) where the main ridge of the Siwáliks flattens down and forms low saddle-backs, which let in the heat from the plains, *viz.*, from the Balinda Rau to the Kansrau Pass (aggregate area 584 acres). Here the type is distributed generally in numerous small patches and narrow strips wherever conditions are favourable; and

(*ii*) close under the low ridge near the Jamna extremity of the Siwáliks, where the type forms a more or less continuous narrow belt about two miles long, and covering about 230 acres.

Elsewhere the type occurs in small patches, few and far between, in favourable places, as on the southern face of the Nágsidh Hill and the southern foot of the Sainkot Hill along the Chandanáwa Rau.

The companion species are those characteristic of dry slopes or the sunny foot of hills. The principal are khair, *Zizyphus xylopyra, Casearia tomentosa, Holarrhena, Randia, Flacourtia, Bauhinia,* &c., with numerous sal in most places.

The quantity of stock is estimated in the following statement:—

Species.	Girth above							Total number of trees of all size-classes.
	9″	1′6″	3′	4′6″		6′		
	And up to							
	1′6″	3′	4′6″	6′				
				Sound.	Unsound.	Sound.	Unsound.	
Sal	8,170	9,355	1,781	108	102	127	37	19,680
Sain	83	226	114	...	...	33	...	456
Sissu	...	...	...	...	...	...	...	...
Chir	120	288	73	31	...	17	...	528
Khair	...	...	...	...	...	...	...	...
Miscellaneous timber trees	39,970	33,835	7,325	2,420	602	1,545	789	86,506
Inferior trees and large shrubs	29,015	19,717	1,393	42	...	...	...	50,167
Bamboo clumps	...	...	...	...	...	...	...	58,986

M.—Miscellaneous timber trees.

Although this has been entered both in the maps and in the various statements as a single type, yet it consists of many completely distinct varieties according to the soil, gradient, elevation and amount of shelter; but it may, for all practical purposes, be resolved into, and considered under, the following four principal sub-types, from the first three of which sal is excluded by insufficient drainage:—

(*i*) That on swampy land, where even during the dry season water is never far from the surface. This is the evergreen sub-type, and consists of a large proportion of evergreen, or nearly evergreen, trees, such as *Machilus odoratissima, Phœbe lanceolata, Putranjiva Roxburghii, Tetrantheras, Celtis australis* and *Roxburghii*, Jáman, *Elæodendron Roxburghii, Olea ferruginea, Toddalia aculeata*, and many shrubs such as the Murrayas and *Adhatoda Vasica*. In some places, by far the most abundant tree is *Mallotus philippinensis* and *Trewia nudiflora*. *Cordia Myxa* and *Bauhinia spp.* are also very plentifully represented. This is the sub-type in

which tun occurs naturally, being in some places, as in the low ground along the Súswa, fairly numerous Over a couple of acres, about a mile and a half south-west of Kánsrau, on the right hand side of the road, is a more or less pure and dense patch of *Pterospermum acerifolium*, the only occurrence of that species in the Dún. The height of the forest is very variable, from 30 to 80 feet, but the growth is nearly always close, and often so dense as to be impenetrable to a man on horseback. Where water is at all times abundant, canes (*Calamus Rotang*) festoon over the trees. A very extraordinary peculiarity remains to be noticed, *viz.*, the presence of ivy near the Re naddi at an elevation of less than 1,900 feet, and of *Quercus incana* at about the same elevation in the swamp west of Banjáráwala. This sub-type covers roughly about 2,500 acres out of a total of 9,996 under the main type.

(*ii*) That on the low, rocky ground forming the banks of streams, and sometimes on the islands in those streams. The characteristic of the soil here is that during more than half the year it is either water-logged or very wet, while during the remainder of the year it is extremely hot and dry down to a great depth. The growth is generally very irregular and open, and consists of amra, elm, simal, *Odina Wodier*, *Lagerstrœmia parviflora*, Albizzias, &c.

(*iii*) That on the badly drained areas on the plateau land, where clay comes close to the surface, represented by the lower portion of the Tírsál Forest, and numerous patches in the Tháno, Nágsidh, and Timli Forests. The species present comprise most of the companions of sal. In respect of density the growth is very variable.

(*iv*) That on dry, rocky exposed slopes, especially those of Himalayan formation. Here *Anogeissus latifolia*, and Bauhinias predominate. The density of growth is very variable, but usually the forest is open.

The quantity of stock comprised in the entire type may be estimated as below:

Species.	Girth above							Total number of trees of all size-classes.
	9″	1′6″	3′	4′6″		6′		
	And up to							
	1′6″	3′	4′6″	6′				
				Sound.	Unsound.	Sound.	Unsound.	
Sal	56,399	42,955	8,791	126	1,306	232	248	110,057
Sain	298	822	459	64	8	24	...	1,675
Sissu	1,786	1,853	538	219	25	22	...	4,443
Chir	49	32	44	16	...	...	...	141
Khair	12,044	18,521	468	...	24	...	...	31,057
Miscellaneous timber trees	438,676	384,781	65,600	13,760	2,201	7,555	5,803	918,376
Inferior trees and large shrubs	286,473	101,621	5,058	...	208	...	...	393,360
Bamboo clumps	...	...	...	...	...	...	...	228

N.—Scrub of inferior species.

This type of growth is due to an unfavourable soil and subsoil, aggravated by absence of conservancy and by destructive fellings during past generations. The component species are mostly the same as the inferior companions of sal and sain. The growth is low and generally very open, but, under proper treatment, is capable of very great improvement.

The subjoined table gives an estimate of the quantity of stock comprised in this type:

Species.	Girth above							Total number of trees of all size-classes.
	8"	1'6"	3'	4'6"		8'		
	And up to							
	1'6"	3'	4'6"	6'				
				Sound.	Unsound	Sound.	Unsound.	
Sál	46,469	52,578	18,801	889	1,873	140	184	114,126
Sain	3,962	5,034	1,337	484	...	201	...	11,018
Sissu	22,155	13,857	187	5	...	...	...	35,704
Chir	2,697	1,535	554	142	...	84	...	5,012
Khair	70,793	35,991	627	168	...	...	...	107,579
Miscellaneous timber trees	184,182	123,414	22,981	4,080	994	3,178	814	339,643
Inferior trees and large shrubs	440,202	147,398	11,600	3,787	...	...	...	604,987
Bamboo clumps	...	...	...	...	...	...	...	76

O.—Open thorny scrub.

This type of growth is the result of former cultivation. It consists principally of low scrub of *Zizyphus nummularia* in the midst of rank grass.

P.—Grassy blanks.

These blanks are either old, abandoned fields perfectly suitable for forest growth, or areas that are water-logged during the rains and must always remain under grass. The former class easily predominates.

Section V.

SPECIAL DESCRIPTION OF THE SPECIES.

There are only two species about which any special observations need be made, *viz.*, sal and sain.

Sal.

In the Dehra Dún this species is situated at the extreme north-westerly limit of its station. A few miles beyond the Jamna the climate along the foot of the Himalayas becomes too dry and, in the hot weather, also too warm for sal. It is therefore evident that sal can never in these forests obtain the same dimensions as it does further east. But besides that the Dún is situated at the north-western extremity of the Sub-Himalayan sal belt, the shallow soil and especially the loose boulder sub-soil (see Appendix I) are opposed to its favourable growth.

Measurements taken during the past seven years in two sample plots give the following average annual rate of increase in the girth of sal trees in the Dún:

At Lachhiwála 0·2" = 5 years for 1" of girth.
At Phándonwála 0·5" = 2 " " "

In the first of these sample plots the sub-soil is clay and the drainage during the rains deficient. The second plot is probably very near the average for the Dún. The measurements have not been continued sufficiently long to furnish entirely trustworthy results, but if we may accept the figure obtained at Phándonwála, and allow 25 years for the complete establishment of the average sal seedling, the mean age at which sal will obtain a girth of six feet is 160 years. This is a very slow rate of growth for that species, but there can be no doubt that as the past generation of trees has developed under adverse conditions, and what we have now left comprises the weaker trees of that generation (the more vigorous

and quick growing ones having been removed when the forest was open to indiscriminate cutting), the crop now coming on will reach a girth of 6 feet before it is 160 years old.

The dimensions attained by sal trees in the Dún will be ascertained by reference to Appendices III and IV, which also give cubical contents and reducing factors.

Coppice shoots developed on stools up to six inches in diameter attain in three years the following average dimensions:—height 10½ feet, girth at 3 feet from the ground 5 inches. After their third year the longitudinal annual increment for the next few years is about 1½ feet.

A remarkable fact connected with the growth of young sal in the Dún requires to be recorded here. Owing to the unfavourable soil, subsoil, and climate, the top of the leading shoot, mainly of young sal wanting protection against rapid nocturnal radiation and severe insolation, often suddenly withers and dies in September-October, and after this a thick brush of shoots develops from below the dead portion and a new leader is then formed with great difficulty. This repeats itself year after until the plant is about 25 feet high, the result being arrested upward growth and a crooked, knotty, not unfrequently hide-bound stem.

Terminalia tomentosa.

Sain attains a very much larger girth here than sal, and girth for girth generally contains more wood. Appendix V gives the dimensions of trees measured together with their contents and the reducing factors.

The average annual girth increment of sain is 0·7 inch which, allowing 15 years for the complete establishment of a seedling, would enable a tree to attain a girth of 6 feet in about 120 years. As coppice also, sain is more vigorous and hardy than sal, and its leading shoot never suffers in the same way as that of the latter species. Sain is an excellent companion for sal; being more shade-enduring, and possessing a different ramification of roots, it grows close up against neighbouring sal, which nevertheless, thanks to its coming into leaf and making its first start in the season's first growth more than two months earlier, is easily able to hold its own against the sain.

CHAPTER III.

ECONOMICAL CONDITIONS.

Section I.

DEMAND AND SUPPLY.

Local requirements are comparatively insignificant, and are to a great extent met from private forests, the aggregate extent of which is very large. In the Reserved Forests grazing is generally light, and except within a radius of 10 miles round Dehra and inside a belt of about eight miles along the Ganges, the demand for firewood is insignificant, and even within those areas the supply is far in excess of the demand. Sal, tun, chir, sissu and sain scantlings, and sal tors (adzed round posts, all heartwood, up to 12 feet long and 18 inches girth near thick end) *in any quantity* find always a ready sale.

The Ganges Canal headworks require every year about 13,000 round pieces of sizes, valued delivered at roughly Rs 8,000. Sal, tun, sissu, sain, bákli, *Albizzia procera*, haldu, jáman, harra and a few other species, being very valuable as timber, are not given. Excepting these, and *Buchanania latifolia*, *Ulmus integrifolia*, simal, *Holarrhena antidysenterica*, *Calosanthes indica*, *Odina Wodier*, *Garuga pinnata*, *Boswellia thurifera*, *Hymenodictyon excelsum* and *Kydia calycina*, which do not last long enough for the purposes of the canal, *i.e.*, from June of one year to July of the next, the Canal Officers accept every kind of wood produced in these forests.

The average selling rates in the Dehra market are as follows :—

Converted timber.

Sal beams	Rs 1-4-0 per cubic foot.
„ karis 15′×5″×4″	„ 45—50 per score.
„ „ 12′ „ „	„ 27—32 „ „
„ „ 10′ „ „	„ 18—24 „ „
„ Bargas 8′ „ „	„ 14 per score.
„ „ 7′ „ „	„ 11 „ „
„ „ 6′ „ „	„ 5 „ „
„ Tors	„ 15—40 per score.
Sain karis 15′×5″×4″	„ 35 per score.
„ „ 12 „ „	„ 24 „ „
„ „ 10 „ „	„ 18 „ „

Unconverted timber.

Sal Ballas, posts, up to 36″ girth	Rs. 40 per score.
„ Ballis, rafters, „ 18″ girth	... 5 „ „
„ Korwas, „ „ 12″ „	Annas 10 per score.

There is also a limited demand for scantlings of harra, jáman, and bákli. Sal fuel is used on a very large scale for lime-burning.

Thus there will never be any difficulty as regards the disposal of sal, sain, sissu, tun, and chir, and, as the available number of them is small, also of harra, jáman and bákli trees. But the complete utilisation of the remaining species in localities not in the neighbourhood of Dehra or the Ganges will, for many years to come, or until the Dún railway is constructed, remain a problem extremely difficult of solution.

Up to the present the forests, taken as a whole, have been worked by the Department up to only about half of their full capability.

Section II.

Export Lines and Markets.

In the Dún, Dehra is the only regular market, although temporary depôts of wood are often established at points on the Dehra-Asárori Road.

Export lines leading out into the plains below are—

(*a*) The Ganges river with the following large markets on it: Kankhal, Dáránagar, Garhmukhtesar, Anupshahar, Farakhábád, and Cawnpore.

(*b*) The Ganges canal with the following markets on it: Jawálápúr, Rúrki, Khatauli, Nánu-ki-mandi (Meerut), Masuri Jhal, Sikandrábád, Newári-ki-jhál, Harduaganj, Barantha, Ráo-ka-Sikandra, Murádánagar and Cawnpore. Rúrki is a very important market on account of the foundry and workshops there.

(*c*) The Mohand first-class road leading to Saháranpúr.

(*d*) The Timli first-class road leading to Saháranpúr.

(*e*) The Jamna with the following markets on it: Jagádhri, Karnál and Delhi.

Section III.

Method of working and rates.

The following methods of working the forests have been tried :—

(*a*) *Leasing out for one year definite areas for the extraction of dead and fallen wood.*—This system saved the establishment much trouble, as the lessees issued their own passes and exercised their own check, and since they understood the demands of the local markets better than the Forest Officers, they probably paid Government a larger sum than would have been collected in detail by the Department directly from petty purchasers. But the method led to collusion between the lessees and the subordinates set to watch them, and trees were killed standing, and even green timber was taken out. The system has now been abandoned, except in respect of driftwood in the streams in the Dún.

(*b*) *Removal, under passes issued to all comers at the Revenue Stations and at the Divisional Office, of green bamboos and of dead and fallen wood.*—Generalised too far, this system leads to the very same defects that characterise the preceding one; but restricted to the removal, under passes valid for one or, at the outside, two days, of small fallen wood, and of marked and girdle-killed trees fit only for fuel, the system is a very desirable adjunct to other and more wholesale methods of working.

(*c*) *Sale of standing trees, specially marked by the Forest Officer, to known trustworthy persons, either at a public auction or by private agreement; the price being fixed either at so much a tree of the given species and class, or at so much per unit of converted produce.*—This is by far the best system to adopt in disposing of a large quantity of valuable produce, and should be generalised as far as circumstances will permit.

(*d*) Extraction, by persons specially authorised by the Divisional Officer, of dead wood in the form of tors, the royalty being fixed per score of tors.

(*e*) *Departmental felling, conversion, and sale.*—This method has been adopted on an extremely small scale. At present it is applied only to the delivery of the wood required for the Ganges Canal headworks; but even in this case it is to be abandoned from the ensuing year.

(*f*) *Sale of grass and other minor produce by lease of a definite area, or on the basis of quantity taken out.*—Both systems are good, and the one or other is desirable according to circumstances.

The grazing is regulated in accordance with rules which will be found published as Appendices D and E to the Annual Report of the School Circle for 1884-85, pages 110—12.

The grazing dues require being raised, for, leaving out of question the damage it does to the soil and the forest, it is absurd to suppose that a cow eats only four annas' worth, or half a two-bullock cartload, of grass during the whole year.

Drift timber in the Ganges is collected departmentally under the rules laid down by the Local Government, and, to prevent friction, the entire control on both banks right down to Meerut is entrusted to the Dehra Dún Division. The Jamna, in respect of the driftwood that comes down it, is under the management of the Jaonsar Divisional Officer, as it is the only export line for the forests of that Division.

Section IV.

Revenue and Expenditure.

Since 1878-79, up to which the present Saháranpúr Division formed part of the Dehra Dún Division, the revenue and expenditure (exclusive of Direction charges) have been as shown under:—

Year.	Revenue.	Expenditure.			Surplus.
		A.	B.	Total.	
	Rs.	Rs.	Rs.	Rs.	Rs.
1878-79	48,490	15,420	23,513	38,933	9,557
1879-80	41,482	9,855	18,702	28,557	12,925
1880-81	54,948	13,165	18,083	31,248	23,700
1881-82	64,068	16,322	15,167	31,489	32,579
1882-83	53,271	24,304	20,625	44,929	8,342
1883-84	64,944	28,289	26,541	54,830	10,114
1884-85	81,797	34,905	22,262	57,167	24,6 0
1885-86	99,654	33,555	22,099	55,654	44,000
1886-87	74,636	36,969	21,214	58,183	10,453

PART II.

DETAILED DESCRIPTION OF THE FORESTS.

THE AMBÁRI FOREST.

Situation and Concessions.—This forest occupies the Ambári Hill, after which it is named, and which is, geographically speaking, an isolated block of the outer Himalayas at the most northerly point of the Dún, close to where the Jamna River issues from the hills. Its boundaries march on the north with those of the Dumet Zamindári; on the east with those of the Tauli Zamindári and portion of the Lángha Zamindári; and on the south-west with those of Lángha, Rudarpúr, Dhartáwála, Dandaka, the Ambári and the Annfield Tea Estates, and Báruwála. With the exception of about two miles along which the Náron Khála and its branches flow, the boundary consists of straight cleared lines following no physical features. Most of the estates mentioned above consist wholly, or in great part, of forest land, which has, however, been stripped of nearly all its valuable timber. The entire area is open reserved forest, in which the following villages enjoy the concession of grazing a fixed number of cattle at half rates as follows:—

Village.	Buffaloes.	Cows and Bullocks.
1. Dumet	10	200
2. Katápatthar	4	60
3. Mihunwála	8	150
4. Tauli	16	75
Total	38	485

The cart track from Rudarpúr to the Jamna cannot be closed.

Configuration and Aspect.—The ground everywhere is hilly and, especially in the eastern portion, rather rugged and steep. The main water-shed line runs close to the eastern boundary of the forest, so that nearly three-fourths of the area are drained westwards, partly into the Udmádi rau and some small affluents of the Jamna, but chiefly into the Udiya rau; while the entire face on the other side of the water-parting is drained eastwards and northwards into the Náron Khála. The highest point is 2,918 feet, and the lowest only about 1,700 feet, thus making a total difference of level of as much as nearly 1,400 feet.

Soil and Geological Formation.—The entire hill is of recent tertiary formation, containing here and there pockets of lignite. The predominant rocks are quartzite, sandstones, and conglomerates, with slates below, and a band of red clay cropping out at places at the lowest points. The soil is thus chiefly a reddish coloured sandy loam of very variable, but generally slight, depth, and covered nearly everywhere with stones and boulders. It is generally dry, except at places on the northern face of the hill, where, up to the commencement of the hot weather, water wells up at the surface near the outcrops of clay. The low undergrowth consists mainly of grass, and the soil, although well suited for sal of moderate size, will seldom produce large timber of that species, except in a few favourable spots.

Stock and Area.—The area is composed as follows:

	Acres.
A.—Under sal, more or less pure	224
B. „ mixed sal and sain	1,894
C. „ mixed sal without sain, but with inferior timber trees	1,260
D. „ mixed sal with inferior species alone	650
N. „ scrub	60
O. „ open thorny scrub	25
Q.—Unproductive	90
Total	4,203

The quantity of stock is thus estimated—

SPECIES.	CLASS. V	IV	III	II		I		TOTAL.
	DIAMETER ABOVE							
	3″	6″	12″	18″		24″		
	and up to							
	6″	12″	18″	24″				
				Sound.	Unsound.	Sound.	Unsound.	
Sal ...	177,855	164,133	44,595	4,737	6,104	88	403	397,915
Sain ...	16,999	16,358	5,078	356	190	70	114	39,165
Inferior timber trees	199,332	79,490	14,552	2,532	2,101	547	983	299,537
Inferior trees ...	197,233	36,876	2,552	331	...	...	...	236,992
Bamboos ...	486	...		...	...	...	...	486
Total ...	591,905	296,857	66,777	7,956	8,395	705	1,500	974,095

From these figures it will be seen that sal is the predominant tree. It is, however, chiefly in the condition of young poles and scattered old hollow trees, the consequence of the forest having been leased about 20 years ago by Ságru Siána of Dumet to Nand Láll Gáta of Dehra, who cleared all saleable produce, leaving only the very young growth and large unsound trees, which it was found unprofitable to cut and convert into a convenient shape for export. Most of the produce was used up as fuel for smelting iron ore brought from near Kálsi across the Jamna, about five miles from the nearest extremity of the forest. The sudden opening out of the forest, and exposure of the young growth to the hot winds that blow across the Jamna, has resulted in the present stunted and languishing appearance of the stock, few of the poles holding out any promise of growing up into well-shaped timber trees. Amongst the inferior timber trees, the most noticeable are numerous bákli and harra, the former chiefly near the foot of the hills and suffering from former lopping for leaves, the latter with sal and sain distributed everywhere. Subsequent to the lease just mentioned, when sal began to be protected, the other species continued to be largely cut for the manufacture of charcoal and iron. This work of destruction was carried on by men belonging to the wandering caste of Maharas who squatted in the forest, and some of whose cultivation terraces are still visible. A small quantity of bamboos, in a very wretched condition from over-cutting, is found along the main water-shed line in company with sal. The forest is very open at the top, but gradually gets denser as the elevation diminishes, and climbers, especially the máljhan, are extremely abundant and destructive.

Reproduction is backward, owing, no doubt, to the rough treatment the forest has undergone, and to the heavy growth of climbers.

Recent History.—Since the forest has been under Departmental management, it has always been open to grazing and has only just been placed under protection from fire. During the past four years, dry wood and minor produce have been removed under leases sold by public auction. Previously, produce was exported by *rawanna* holders.

Accessibility.—This forest is extremely conveniently situated for export, being near the Chakráta—Saháranpúr military road and the Jamna river. Carts can reach it on every side, and can also penetrate into many places in the interior, so that export of logs of the largest size that the forest can produce will never be difficult.

Component Blocks.—The Ambári Forest is divided into the two following blocks :—

THE TAULI-LÁNGHA BLOCK.

Situation and Concessions.—This block comprises the eastern face of the Ambári Hill. On the north and east it adjoins the villages of Páprián, Tauli

and Lángha, the greater portion of the boundary being formed by a branch of the Náron Khála ; on the south the villages of Lángha and Rudarpúr, and on the west the Dumet block. Of the four Zamindáris enjoying the concession of grazing a fixed number of cattle at half rates, Tauli alone adjoins it, and is near enough to exercise that privilege in this block.

Configuration and Aspect.—Every part is steep and rugged, especially the easterly and northerly slopes in the middle of the block, which are cut up by numerous deep ravines. The block lies unequally astride a prominent spur which forms the water-shed line between the Náron Khála, on the north, and the Udmadi and Udiya raus on the south. The slopes drained into these two latter streams (the smaller portion of the area) have generally a southerly aspect, while of those drained into the Náron Khála, the southern half look north and the northern east. The highest point is 2,918 and the lowest about 1,900 feet above the level of the sea, the average being about 2,600 feet.

Soil and Underlying Rock.—The same as for the forest. Shales predominate at the eastern extremity, where also the coal deposits are chiefly found.

Area and Stock.—The area is composed as follows :—

	Acres.	
A.—Under sál ...	166	On eastern protected slopes in the middle of the forest, overlooking Pasanti, and a smaller area at the extreme north.
B. „ mixed sál with sain ...	472	Chiefly in two large patches, one forming the southern extremity of the block, the other in very rugged glens north of the larger area under the preceding type.
C. „ mixed sál without sain but with inferior timber trees.	36	
D. „ mixed sál with inferior species alone ...	614	The greater portion of the rest of the area.
N. „ scrub ...	60	Chiefly at the northern extremity.
Q.—Unproductive	39	
Total	1,387	

The only special remark to make here is that bamboo is practically absent, and that the growth of sál is best on easterly slopes, thanks to the protection such slopes enjoy from the hot west winds. Moreover, climbers are not so abundant here as in the rest of the forest.

Recent History.—No special remarks required.

Accessibility.—Two cart tracks run across the eastern extremity of the block.

The Dumet Block.

Situation and Concessions.—This block occupies the whole of the western face of the Ambári Hill (rather more than two-thirds of the area of the forest). It is bounded on the north by the village lands of Dumet and Tauli; on the east by the Tauli-Lángha block ; on the south by the Tauli-Lángha block, Rudarpúr and Dhartáwála ; and on the west by the Dándaka and Ambári and Annfield Tea Companies' forests.

Configuration and Aspect.—With the exception of the northern extremity, which has a northerly aspect, the rest of the ground falls chiefly to the west. The slopes here are less rugged and less steep than in the preceding block.

Soil and Underlying Rock—On the whole, the soil is better than in that block, and sandstones and conglomerates predominate.

Area and Stock.—The area is cropped as follows:—

		Acres.	
A.—Under sál	... ...	58	In two patches in the south.
B. „ mixed sál with sain	...	1,422	In two patches, by far the larger occupying the middle of the block, the other in the north.
C. „ mixed sál without sain, but with inferior timber trees.		1,224	The greater portion of the remaining area.
D. „ mixed sál with inferior species alone.		36	Principally along the highest portion of the water-shed line.
O. „ open thorny scrub	...	25	The north-western corner.
Q.—Unproductive	... ...	51	
Total	...	2,816	

The small quantity of bamboo found in the Ambári Forest is limited to the south-eastern portion of this block, which also contains the greater proportion of the harra trees. As might be expected, the stock is worst in the northern half of the block, whence export of fuel for smelting purposes was easiest. The piece of flat ground at the north-western extremity, having been at one time under cultivation, and being in the immediate vicinity of the hamlet of Dumet, has degenerated into an open, thorny scrub.

Recent History.—Nothing special.

Accessibility.—Owing to the easier gradients, and the vicinity of the Sahá-ranpúr-Chakráta military road, and to flat, even ground, export from this block is easier than from the Tauli-Lángha block.

THE CHÁNDPÚR FOREST.

Situation and Concessions.—The Chándpúr Forest is situated about a mile and a quarter to the north-east of the village of Sahenspúr. It is bounded on the north by the Kothi Naddi, separating it from the Surna Grant; on the east by Chándpúr Khurd and Kalán, the Hurráwála Grant and Dhúmnagar; on the south by the Attic Farm and Hukúmatpúr Grants; and on the west by the Hukúmatpúr and the Chhaba Grants.

The entire area is open, reserved forest, and the following villages are allowed to graze at half rates the number of head of cattle entered opposite them:—

Name of village.	Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
1. Sahenspúr	108	500	25	...
2. Dháki	10	140	12	125
3. Abdulapúr	4	50	...	...
4. Karímpúr	40	80	...	...
5. Rámsaháiwála	2	60	...	...
6. Hurráwála	55	235	15	50
7. Tilwári	4	100	...	...
Total ...	223	1,165	52	175

Passage to the public is allowed through the forest from Hurráwála to Sahenspúr. Most of the tracts surrounding the forest consist of private forests, the greater portion belonging to Mr. Vansittart, who keeps out grazing and undertakes a certain amount of protection. The Zamindár of Sahenspúr has leased his forest for a series of years for Rs. 22,000.

Configuration and Aspect.—The forest is situated on flat ground drained by numerous water-courses running south-west. These form deep ravines with almost vertical sides, and render the surface very uneven in the western half, where they converge, before they meet and join the Asan. The south-eastern extremity is, however, traversed by the broad bed of the Chor Khála, which, at its widest, measures about 200 yards.

Soil and Geological Formation.—The soil is generally a deep, sandy loam, often becoming strongly clayey, and overlies boulders or a loose conglomerate or, in many places, a band of stiff red clay, which crops out at the surface, and is sometimes exposed over a considerable area. Owing to this clay band, the permanent level of water is at least 40 feet below the surface, on which account, and also because of the clayey nature of the soil, sál will never attain here more than moderate dimensions. The growth of grass is abundant nearly everywhere, and reaches a height of five to seven feet.

Stock and Area.—The area is divided between the various types thus—

	Acres.	
A.—Sál more or less pure ...	316	In several patches in the north.
D.—Mixed sál with inferior species alone	1,594	The greater portion of the block.
O.—Open thorny scrub... ...	66	Chiefly in two places; a large patch in the north-east and a long strip in the Chor Khála.
P.—Grassy blanks	67	In several patches, the remains of old cultivation and low-lying land along the Chor Khála.
Q.—Unproductive	208	
Total ...	2,251	

The quantity of stock is estimated as follows :—

	V	IV	III	II		I		Totals
Sál ...	94,767	51,794	21,006	924	695	54	165	169,405
Sain ..	4,807	3,379	1,154	64	32	16	16	9,468
Inferior timber trees.	73,792	27,334	2,643	429	382	63	111	104,754
Inferior trees ...	43,665	9,825	542	22	...	...	...	54,054
Totals ...	217,031	92,332	25,345	1,439	1,109	133	292	337,681

This forest has been heavily cut over at some former time, which fact, combined with the dry and unfavourable soil and subsoil, accounts for the large proportion of unsound individuals among the larger sál, and the stunted and often unhealthy appearance of the poles of that species. The stock consists chiefly of poles on stools, interspersed with trees, the majority of which were apparently not good enough to be exported before the advent of the Forest Department. The best stocked portion is the eastern half, in which also the reproduction of sál in the shape of young coppice is, on the whole, very good. In the same

portion the small treeless areas, being sites of former cultivation, are filling up with sál. In the western half the forest is much more open, besides being of inferior quality, and there is much to be desired under the head of reproduction.

Sain is generally thriving wherever it grows, as on the slopes and along the banks of ravines, and it is also extending itself in the midst of the sál. Amongst the inferior timber trees, the most noticeable are bahera, harra, jáman, piáman, and Elæodendron. Climbers, chiefly máljhan, are abundant in many places.

Recent History.—The dry wood and minor produce have been leased annually since 1879-80, and grazing has always been unrestricted. Owing, however, to the coarse grass and the vicinity of large private forests affording better pasturage, the number of cattle driven into this forest has never been large. The forest has been protected from fire since last year, but is open to grazing.

Accessibility.—The flat nature of the ground renders export from every point extremely easy, and the produce can pass out by the Dehra-Rámpúr Mandi road to either of those two places, or by the Timli pass road into the plains below. The cart-track from Hurráwála to Sahenspúr is an excellent one, and another fairly good track branches off from it towards Chándpúr.

Component Blocks.—The area of the forest is so small that it composes of itself a single block.

THE DHAULKOT FOREST.

Situation and Concessions.—This forest is situated on the Dehra-Rámpúr Mandi road, about 7½ miles from the former place. It is bounded on the north by the Bakhtáwarpúr, Bhánwála, and Naungáwán zamindáris; on the east by the Mánduwála, Bishanpúr and Sudhonwála zamindáris; on the south by Jhájra, Dhúm Singh's and Mrs. Dick's Dhaulkot, Mahra-ká-gáon and Shíshambári; and on the west by the Central Hopetown, Attic Farm, and the Rájáwála Grants. The entire area is an open reserve, and the undermentioned villages graze the allotted number of cattle at half rates:—

Name of village.	Buffaloes	Cows and bullocks	Ponies and donkeys	Sheep and goats
1. Jhájra	25	500	10	200
2 Máhra-ká-gáon	3	80	3	...
3 Súdhonwála	10	50	...	20
4. Dhaulkot	...	24	...	...
5 Mánduwála	16	150	...	...
6. Naugáwán	8	130	...	...
7. Bháuwála	10	150	20	...
8. Rájáwála	12	125	...	...
9. Bakhtáwarpúr	14	135	...	...
10. Bhagwánpúr Jula	8	120	...	...
Totals ...	106	1,464	33	220

The inhabitants of the above-named villages are also allowed to collect head-loads of fallen, dry wood for fuel, under free passes given by the Divisional Officer. Moreover, the road through the forest from Mánduwála to Jhájra is intended to be always kept open.

Configuration and Aspect.—The forest forms part of a plateau raised about 100 feet above the immediate valley of the Tons river. It is traversed from north-east to south-west by numerous ravines, many of which, especially in the eastern portion, cease with the edge of the plateau. The entire drainage passes into the Tons river, which has cut off a small portion of the area at its south-western extremity. The most important water-courses are the Bainkhála Naddi, which forms the greater portion of the western boundary, the Joli Khála, a branch of that stream, the Ráráwáli rau, and a stream that loses itself opposite Jhájra. The land is thus flat, but cut up into long strips by the numerous ravines. The highest point above the sea is about 2,200 feet, and the lowest about 1,700 feet, a total difference of level of only 500 feet.

Soil and Geological Formation.—The geological formation is similar to that of the Chándpúr Forest, except that the clay band, and therefore the water level, is nearer the surface. The soil is a fairly stiff, sandy loam, generally of considerable depth, except where the clay band comes to the surface, as, for instance, along the Jhájra-Naugáwán road, where it constitutes the soil by itself. The soil is thus generally rich and covered, except in a few places where the leaf-canopy is too dense or the red clay crops out, with a very heavy crop of grass and some low shrubs, such as *Grewia sclerophylla, &c.;* it is a soil in which sál, under proper treatment, will attain its finest dimensions, and in which sain thrives extremely well.

Stock and Area.—The area is stocked as follows:

	Acres.
A.—Sál more or less pure	3,553
B.—Mixed sál with sain	483
O.—Open, thorny scrub	322
P.—Grassy blanks	173
Q.—Unproductive	279
Total ...	4,810

The following is the estimated total quantity of standing stock:

Species.	CLASS. V	IV	III	II		I		Totals.
	Diameter above							
	3"	6"	12"	18"		24"		
	and up to							
	6"	12"	18"	24"				
				Sound.	Unsound.	Sound.	Unsound.	
Sál	467,139	232,177	50,572	2,656	1,812	161	171	754,688
Sain	16,978	7,949	1,060	362	111	55	14	26,529
Inferior timber trees ...	71,011	17,979	3,517	502	261	82	41	93,393
Inferior trees	156,727	28,813	2,173	117	...	...	...	187,830
Totals ..	711,855	286,918	57,322	3,637	2,184	298	226	1,062,440

This is essentially a forest of sál poles, the few trees of any size remaining being principally such as their unsoundness or ill-shape caused to be spared during the wholesale destruction of the Dún Forests during the first-half of this century. Generally speaking, these poles are well grown and full of promise, and in spite of former annual fires, and, in many parts, heavy grazing, small coppice

shoots of sál are very abundant, and only require protection from fire and ordinary conservancy measures to shoot away above the grass, and fill up most of the numerous glades which occur everywhere. Many sál stumps are still to be found up to seven and eight feet in girth, and until two years ago there was a large sál, quite sound, just over 10 feet in girth. Under proper treatment this forest will become, area for area, one of the most valuable in the Dún.

Recent History.—Before this forest came under the control of the Department it was cleared of all its large timber, and heavy fellings even of small wood must have been made for the supply of Dehra, and especially for the manufacture of lime in the Tons river. After that event, owing to the proximity of the forest to Dehra, dry wood, grass and other minor produce have continued to be regularly exported; but no green trees have been felled either regularly or on any considerable scale. Since 1877-78, all dead fallen wood and minor produce (chiefly thatching grass and including limestone in the Tons) have been leased annually, and for two or three years dead standing trees have also been so disposed of.

Attempts to protect the forest from fire were made in 1883 and 1884, but the absence of all system doomed them to failure. Protection has, however, been assured since 1885.

Accessibility.—There is no point of the area that is not easily accessible to carts, and its admirable situation with respect to population and cultivation renders every stick of produce marketable.

Component Blocks.—The forest is divided by the Jhájra-Naugánwán road into two blocks, the descriptions of which immediately follow :

THE BAIN KHÁLA BLOCK.

Situation and Concessions.—This block forms the western portion of the Dhaulkot Forest. It adjoins on the north, Bakhtáwarpúr, Bhauwála and Naugánwán; on the east and south the Jhájra block, Mrs. Dick's Dhaulkot, and Mahra-kágáon; on the south by the Shishambári Grant; and on the west and north by the Central Hopetown, Attic Farm, and Rájáwála Grants, the Bain Khála stream forming the greater portion of this boundary.

Configuration and Aspect.—This block is the flattest and lowest portion of the Dhaulkot Forest, many depressions occurring in the southern half.

Soil and Underlying Rock.—No special remarks required.

Stock and Area.—The area is stocked as under :—

		Acres.	
A.—Sál more or less pure	...	1,914	The greater portion of the block.
O.—Open, thorny scrub	...	215	Two large stretches at northern extremity, and the vicinity of the Naugánwán-Jhájra Road.
P.—Grassy blanks	...	75	Chiefly at the southern extremity.
Q.—Unproductive	...	104	The beds of the streams, particularly of the Bain Khála.
Total	...	2,308	

The lower or southern half of the block is interspersed with long stretches of grass land, in which, however, young saplings are now coming on well along the edges of the strips of standing forest. The northern half is, on the whole, well stocked. Small and middle-sized poles predominate, individuals of large size being few and far between and generally unsound. Except in the middle of the grass areas and open thorny scrub, sál reproduction is almost all that can be desired.

Recent History.—The greater portion of the lower end of the block has been under cultivation, and was formerly heavily and repeatedly cut over, probably for burning lime in the Tons. It is heavily grazed over.

Accessibility.—Carts can circulate without difficulty throughout the area, but the interposition of the Jhájra block between it and Dehra, and the small quantity of fallen wood in it, due to the absence of fellings, prevent any large resort to it on the part of the kumhárs and other small exporters of firewood and minor produce from Dehra. But in a few years, when the denudation of the remaining private wooded areas in the neighbourhood of that town has progressed a point further, the stream of small daily traffic is bound to find its way in here.

THE JHÁJRA BLOCK.

Situation and Concessions.—This block, the eastern portion of the Dhaulkot Forest, is situated at an average distance of seven miles from the town of Dehra, and is bounded on the north and west by the Bain Khála block, and Mrs. Dick's and Dhúm Singh's Dhaulkot; on the east by Naugánwán, Mánduwála, Bishanpúr and Sudhonwála; and on the south by Jhájra.

Configuration and Aspect.—The plateau character of the Dhaulkot tract is most evident in this block, the southern edge of which is a bank from 40 to 100 feet high. Moreover, the ground here is more broken, and cut up by more numerous, but much smaller, ravines than Bain Khála.

Soil and Underlying Rock.—The band of red clay is more exposed in this block than in Bain Khála.

Stock and Area.—The area is stocked as under:—

	Acres.	
A.—Sál more or less pure	1,639	Most of the area beyond southern edge of plateau.
B.—Mixed sál with sain	483	Chiefly along southern edge of plateau.
O.—Open, thorny scrub	107	In several patches, the remains of old cultivation.
P.—Grassy blanks	98	In several patches, the remains of old cultivation.
Q.—Unproductive	175	Mainly the broken ravines formed by the numerous water-courses.
Total ...	2,502	

The stock resembles that of the northern portion of the preceding block. Numerous glades occur in the middle of the area, the remains of former fields, which are, however, filling up rapidly with splendid sál reproduction. The most open patches are in the north, which are also the most heavily grazed over.

Recent History.—Many years ago a village occupied the middle of the block, as is attested by bricks scattered everywhere and the numerous blanks now filling up with young growth. Grazing is very heavy at the northern extremity and the southern extremity shows signs of heavy fellings in a near past for fire-wood.

Accessibility.—Every portion of the block is accessible to carts, and several good cart tracks traverse it. As a consequence of this circumstance and its near neighbourhood to Dehra almost every stick produced is exported.

THE JAMNA FOREST.

Situation and Concessions—This forest consists of two distinct belts; one of them by far the larger of the two, extending eastwards from the Jamna over the northern face of the Siwáliks, while the other stretches northwards along the low flat ground forming the left bank of the Jamna, and is separated from the former by a strip of land a foot wide. The entire area is open reserved forest. The following private estates march with it on the north:—Kulhál, Matak Májri, Kúnja, Kúnja Kárghi, Grant Áduwála and Sháhpúr, on the east the Katha-ka-rau separates it from the Sháhpur block of the Timli Forest; and on the south the main water parting of the Siwáliks divides it from the Dhaula block of the Saháranpúr Division. With the exception of a few patches of scrub or groups

of trees, there is no private forest of any kind adjoining or in the immediate neighbourhood. The following villages have been granted the concession of collecting head-loads of firewood for their own use, and of grazing a fixed number of cattle at half rates:—

Name of village.	Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
Matak Májri and Kulhál ...	10	200	...	...
Kúnja	18	180	5	...
Kúnja Kárghi	14	120	3	...
Aduwála	50	190	8	...
Sháhpúr	25	170	...	...
Dharmáwála	40	50	...	...
Timli with Jharbeli ...	65	146	22	250
Májri	10	150	...	...
Játonwála	40	30	...	...
Kaliánpúr	4	32	...	...
Típápúr	...	40	...	...
Sabháwála	45	290	...	...
Sherpúr	15	90	...	...
Hasanpúr	4	50	...	...
Shishambári	3	340	...	...
Kándliwith	...	...	...	...
Haripúr	60	300	10	260
Pelion	10	250	...	...
Carberry Grant	8	100	...	...
Malhán	18	260	...	...
Harbhajwála	15	300	...	...
Mihunwála	50	300	4	60
Pithuwála	10	40	...	...
Májra	50	225	10	...
Sheola Kalán	50	260	...	...
Sheola Khurd	8	60	...	...
Mohabbawála	26	50	...	...
Totals ...	648	4,323	62	570

Practically, however, only the first six villages can fully profit by the concession, all the rest being situated at too great a distance. Hence the number of cattle to be provided for, in case any portion of this area is at any time closed, will be as follows: 157 buffaloes, 910 cows and bullocks, and 16 ponies and donkeys.

Configuration and Aspect.—The greater portion of the Siwálik area consists of extremely rugged and broken ground, especially the portion overhanging the Jamna, the western extremity excepted, where there is a flat expanse of grazing ground, and graziers squat during the greater part of the year. From the Karaundi rau, opposite Matak Májri eastwards, the ground opens out, and the hilly belt contracts in proportion. Here the hills also become less rugged, and the flat ground is traversed by numerous ravines and streams of all sizes running due north and carrying their drainage into the Asan. The chief among these water-courses are the Nandiwála, Patrauli, and Jamnáwála raus and the Katha-ka-rau, while those which run directly into the Jamna are the Dauláwála rau, forming half the southern boundary, the Mundiwála, Bura Said, and Karaundi raus. The slopes at the eastern extremity of the forest have a westerly aspect, otherwise the ground everywhere falls northwards. The highest and lowest elevations above the sea level are respectively 3,000 and 1,200, a maximum difference of level of 1,800 feet.

The smaller, isolated, detached area includes principally flat islands in the Jamna and Ásan rivers, and a small portion of the mainland at Rámpúr-Mandi. The average elevation of this tract is about 1,280 feet.

Soil and Geological Formation.—On the slopes of the Siwáliks generally there is very little soil, and the rocks which compose the range here are chiefly sandstones and conglomerates with a band of soft, red slate, which, when it appears at the surface, weathers into a kind of lateritic soil. The flat portion below the Siwáliks is alluvial, being a sandy loam resting chiefly on boulders and rolled stones. Everywhere the soil is dry, except, of course, in the vicinity of the Jamna and Ásan rivers. In the lower portions the growth of grass is heavy, but becomes lighter with increasing gradient and elevation. The soil in about half the area is well suited for sál.

Stock and Area.—The entire area is divided as follows :—

	Acres.
A.—Sál more or less pure	2,849
D.—Mixed sál with inferior species alone	1,518
F.—Sissu	1
G.—Khair	28
H.—Mixed sissu and khair	24
L.—Mixed bamboos	322
N.—Scrub	2,377
O.—Open, thorny scrub	351
P.—Grassy blanks	423
Q.—Unproductive	1,237
Totals ...	9,130

The following is the estimated total quantity of standing stock :—

Species.	CLASS. V	IV	III	II		I		Totals.	Remarks.
	Diameter above								
	3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"			
				Sound.	Unsound.	Sound.	Unsound.		
Sál	123,223	114,733	36,919	1,517	3,236	244	659	280,531	
Sain	1,160	1,728	359	161	172	28	28	3,636	
Sissu	137	103	47	8	...	...	...	295	
Khair	6,677	2,107	168	36	...	...	...	8,988	
Inferior timber trees ...	27,641	30,373	9,111	1,181	648	325	306	69,585	
Inferior trees ...	148,067	34,208	18,774	1,755	...	...	...	202,804	
Bamboo clumps ...	6,826	...	...	...	...	...	...	6,826	
Total ...	313,731	183,252	65,378	4,658	4,056	597	993	572,665	

On the flat ground along the Jamna are chiefly grass lands, interspersed with an open, thorny scrub of ber and khair with a few other species, khair being predominant on the islands, and sissu being represented on a very small scale.

On the hill portion overhanging the Jamna the stock is extremely varied in response to the sudden changes of soil, aspect, and gradient. Sál, pure or

mixed, runs along certain plateaux and spurs, but the greater portion of the stock consists of inferior species. The growth is generally sparse and comparatively young. On the lower slopes and at the foot of the hills, máljhan is extremely abundant.

In the rest of the forest there are four main belts of growth. The highest, little more than a quarter of a mile wide and running along the water-shed, consists of a scrub of inferior species, such as *Buchanania*, dháura,* bákli, sándhan, sálar, &c. Then comes a slightly narrower belt of bamboo mixed with most of the above species, and sál, bahera, &c., the bamboo being extremely over-cut and in a miserable condition. Below this, bamboo disappears and the proportion of sál increases. Lastly, before we reach the foot of the hills and right down to the boundary line, there is a broad expanse of more or less pure sál. The sál is everywhere stunted and deformed, and trees of any size are generally wanting, the result probably of large export operations in the past.

In the whole of the western portion the reproduction of sál is very backward, but it is much better elsewhere, and in a great many places it may be said to be remarkably good.

Recent History.—The forest has never been protected from fire, and no fellings of green trees have been made since the advent of the Forest Department; but, besides minor produce, dry wood has been exported in the form of tors and fuel. Since 1880-81, these classes of produce have been leased.

Accessibility.—This forest is admirably situated for export on the Jamna river, which becomes fit for rafting at a point much above these forests.

Component Blocks.—The forest is divided into four blocks as follows:—

	Acres.
Dhaula	2,636
Kulhál	3,261
Áduwála	2,408
Mandi	825
Total ...	9,130

THE DHAULA BLOCK.

Situation and Concessions.—This is the most westerly portion of the Dehra Dún forests, and is situated in a bend of the Jamna river, which forms the whole of its western and most of its northern boundary. On the east lies the Kulhál block, and on the south the Khára Block of the Saháranpúr Division. For concessions see description of the forest above.

Configuration and Aspect.—With the exception of about 300 acres at its western extremity, which comprise flat land or river bed, and about 80 acres along its northern boundary, the ground is extremely rugged and broken. The water-courses form deep ravines with precipitous sides up to 180 feet high, and in the midst of this broken ground some of the spurs flatten out into plateaux of limited extent. Owing to the very irregular contours the aspect is continually changing, but the drainage goes chiefly northwards and westwards into the Jamna. The highest point is about 1,000 feet above the Jamna, the elevation of which above the sea level is here about 1,250 feet.

Soil and Underlying Rock.—The depth and nature of the soil varies very considerably with the aspect, gradients, and elevation. In the flat land on the Jamna and near the northern boundary the soil is alluvial, a rich, sandy loam, producing a heavy crop of grass. On the plateaux the soil is rather a stiff loam, containing a large proportion of red clay. Elsewhere it is generally shallow and stony, the finer elements being a sandy or gravelly loam, overlying sandstones and conglomerates. As a rule, this block is unfavourable for the growth of sál. Bhábar grass is very abundant, especially on the dry, higher ridges and slopes.

Stock and Area.—This area may be divided as follows :—

	Acres.	
D.—Mixed sál with inferior species alone ...	746	Several patches and belts, occupying principally the flat ground and easy slopes in the hilly portion.
F.—Sissu	1	A very small island in the Jamna at the southern extremity.
G.—Khair	20	Two small islands at the southern extremity.
N.—Scrub	1,141	Chiefly the steeper and rocky ground.
O—Open, thorny scrub	252	The flat land forming the bank of the Jamna.
P.—Grassy blanks	14	Mainly in contiguity with the preceding type.
Q.—Unproductive	462	Chiefly the Jamna river and steep, rocky slopes.
Total ...	2,636	

The stock is as varied as the configuration, aspect, and soil; perfectly distinct types prevailing side by side and dove-tailing into each other. The growth is generally very open. Sál prevails principally on the lower slopes, but forest of it is everywhere interspersed or seamed with patches and belts of inferior scrub, which type predominates everywhere in the higher and more hilly portions of the block. This scrub consists chiefly of *Buchanania*, tendu, sándhan, bákli, sálar, &c.

Everywhere the trees are nearly all of slight girth, and seldom exceed 30 feet in height, so that the forest growth is of a very inferior description. Climbers are extremely abundant on the lower slopes. Reproduction is also very backward, owing doubtless to the very unfavourable conditions of soil and climate prevailing. Shrubby undergrowth is not abundant, and consists of *Indigofera*, *Randia dumetorum*, karaunda, &c.

Recent History.—Owing to the very difficult ground, grazing is confined chiefly to the flat ground on the Jamna, where there is a regular squatters' village called Bagsen, and which is heavily grazed over by cattle from the Sahárapúr and Ambála districts. This block could at no time have been well stocked.

Accessibility.—No point is further than two miles from the Jamna; so that, although very few portions of the area are accessible to carts, the export of timber will never be difficult, and even firewood could be taken out with profit when any considerable demand for it should arise along the banks of the Jamna lower down.

The Kulhál Block

Situation and Concessions.—This block is situated between the Dhaula block on the west and the Aduwála block on the east. The private lands of Kulhál, Matak Májri and Kúnja march with it on the north and the Khára open block of the Sahárapúr Division, across the main water parting of the Siwáliks, on the south. For concessions see description of the forest above.

Configuration and Aspect.—This block is also extremely hilly, but there is a belt of flat land traversed by ravines and from a mile to a mile and a half wide along its northern boundary, opposite Matak Májri and Kúnja. The western portion resembles in configuration, the adjoining eastern half of the Dhaula block. All the streams flow north, some directly into the Jamna,

others into the Ásan. The Karaundi rau is a very large water-course, draining a quarter of the entire area and forming a very broad bed of boulders. The general fall of the ground is, of course, northward, but the very irregular configuration of the hilly portion creates a great variety of local aspects.

Soil and Underlying Rock.—In the hilly portions, especially in the western half, the soil and rock are very similar to that in the adjoining portion of the Dhaula block. Elsewhere the soil improves very much with diminishing elevation. It is generally a sandy loam overlying sandstones and conglomerates in the upper portion, and shingle and boulder deposits lower down, and is favourable for the growth of sál. The crop of grass is heavy on the good soil.

Stock and Area.—The area is stocked thus—

	Acres.	
A.—Sál more or less pure	1,204	All the flat and easier protected lower slopes.
D.—Mixed sál with inferior species alone ...	636	Above the preceding type.
L.—Mixed bamboos	166	A long, narrow belt above D.
N.—Scrub	1,055	Along the water-shed, and in the very broken ground in the basin of the Karaundi rau.
P.—Grassy blanks	22	
Q.—Unproductive	178	
Total	3,261	

In the western portion, comprising the basin of the Karaundi and Bura Said's raus, the stock is similar to that in the adjoining portion of the Dhaula block, but the vegetation of the trees is, in general, of a better character. The sál is here confined chiefly to the cooler, moister, sheltered easterly and northerly aspects.

In the rest of the block we find the four main belts of growth, sketched above under the general description of the forest. The sál is in most places stunted and deformed, and occasionally degenerates into mere scrub. Next to sál, sándhan at the lower elevations, and *Buchanania* on the upper drier slopes, are the most abundantly represented trees. The density of growth in the sál portions is generally fairly complete, and the trees are about 35 feet high.

The reproduction of sál in the sál tracts is, on the whole, satisfactory. The shrubby undergrowth is the same as in the preceding block, and máljhan is very abundant.

Recent History.—The lower portions up to the foot of the hills are heavily grazed over. The fire protection of the block has never yet been undertaken.

Accessibility.—Although generally more distant from the Jamna, the block is, thanks to the easier ground, as well situated for export as Dhaula.

THE ÁDUWÁLA BLOCK.

Situation and Concessions.—This block is the most easterly portion of the Jamna Forest, and is separated on the west, from the Kulhál block, by the Nandíwála rau; on the north its boundary marches with those of the private lands of the Kúnja-Kárghi Grant, of Áduwála and of Sháhpur; on the south the main water-shed line separates it from the Khára block of the Saháranpúr Division.

Configuration and Aspect.—The hill or Siwálik portion constitutes the upper third of the block. The slopes and spurs are fairly regular, and the ground is much less steeper than in the two preceding blocks. The general fall of the land is, of course, northwards, but the numerous spurs and ravines produce a variety

of rapidly changing aspects. Below the hilly portion, the ground assumes chiefly a plateau character. Broad, flat expanses are common, but numerous ravines and water-courses cut up the surface, especially near the lower edge of the plateau. The principal streams, with broad boulder beds, are the Patrauli, the Tauriwála and the Jamnáwála raus.

Soil and Underlying Rock.—In the steeper, hilly portions the soil is shallow, stony, dry, and poor, but varies to some extent with the aspect. Below this, it improves very rapidly, becoming a fairly rich, sandy loam, generally deep and well adapted for sál, and bearing a heavy crop of grass. In the Siwáliks, the geological formation is alternating sandstone and conglomerate, while in the flat portions the soil generally overlies shingle and boulder deposits.

Stock and Area.—The condition of the area as regards forest growth is as follows:—

	Acres.	
A.—Sál more or less pure ...	1,645	All the lower four-fifths of the block.
D.—Mixed sál with inferior species alone	136	A narrow belt above A.
L.—Mixed bamboos	156	Ditto D.
N.—Scrub	181	Ditto L. along watershed line.
P.—Grassy blanks	10	
Q.—Unproductive	280	
Total	2,408	

The four main belts of forest growth referred to under the description of the forest, are very distinctly represented here, the sál belt occupying three-fourths of the length of the block. The sál is chiefly in the condition of poles, very much damaged by previous reckless fellings and annual fires, but the few old trees still left prove that under protection this block will be able to produce fine sál trees again. The stock is, as a rule, fairly dense, and its average height is about 40 feet.

The reproduction in the sál tract is very abundant, and almost all that can be desired; annual fires are, however, keeping it back. Máljhan is very abundant everywhere, except on bare, rocky hillsides.

Recent History.—The lower portion of the block is heavily grazed over, and there is no doubt that fellings of sál on a large scale took place before 1862.

Accessibility.—Numerous cart-tracks traverse the block from south to north, and, owing to the predominance of flat ground, export will at all times be easy, both by the Jamna river and the Timli Pass Road.

THE MANDI BLOCK.

Situation and Concessions.—This is the detached block of the Jamna Forest referred to above. It is situated in the angle formed by the Jamna and Ásan rivers, and comprises, with the exception of about 80 acres of the mainland, islands in those streams. The northern and western boundary is the middle line of the Jamna, which separates the block from Náhan territory; on the east and south are the private lands of Dhálipur, Kúnja, and Matak Májri. Although this is treated as an open reserve, still no concessions of any kind have been granted in it, except passage through it to the ferry across the Jamna.

Configuration and Aspect.—As is to be expected, the entire area is flat and low-lying, being only a few feet above the rivers at their cold-weather level.

Soil and Underlying Rock.—The soil is of course alluvial, being chiefly a fine silt overlying shingle and boulders of quartzitic sandstone. The depth of the silt varies from 0 to 8 and 10 feet. Many of the lowest-lying portions are under water during the floods of the Jamna.

Stock and Area.—The area is under the following types :

		Acres.	
G.—Khair	...	8	Two small patches in the Jamna, south-west of Forest Rest-House.
H.—Mixed sissu and khair	...	24	Two large patches in the Jamna, opposite staging bungalow in Náhan territory.
O.—Open, thorny scrub	...	99	A large island in the Jamna, stretching westwards from Forest Rest-House.
P.—Grassy blanks	...	377	Chiefly the islands.
Q.—Unproductive	...	317	
Total	...	825	

This block consists chiefly of grass land, dotted with trees of simal, jíngan, sissu, khair, haldu, &c. The average height of khair is about 20 feet, but the quality is not good. Climbers are nearly absent. Here and there the reproduction of khair is fairly good, but taking the forest as a whole the amount of reproduction may be considered almost *nil.*

Recent History.—This block has never been protected from fire, and grazing is permitted without restriction, and is extremely heavy. It was attached to the Jaunsár Division up to 1879, when it was transferred to the Dehra Dún Division. The right of cutting and exporting grass is leased every year, and places in the block are used as general depôts or stacking sites for private and Government timber from the Dún, and from the hills on its way down-country by the route of the Jamna.

Accessibility.—Obviously, nothing could be more accessible than this block.

THE TIMLI FOREST.

Situation and Concessions—This forest is situated on the Saháranpúr-Chakráta military road between the Kathá-ká-rau, separating it from the Jamna Forest on the west and the Súkh rau separating it from the Sherpúr Forest on the east ; on the north it is conterminous with the private lands of Sháhpúr, Dharmáwála, Partítpúr, Badripúr, Mednipúr, Májiri, Játonwála, Tiparpúr, Jirwála, Sabháwála, and Kaliánpúr ; and on the south and south-east the water-shed line of the Siwáliks separates it from the Bádsháhi Bágh, Chhapri, Khaironwála, Barkala, Kasumri, and Sahensra blocks of the Saháranpúr Division. Enclosed in it are two plots of private land, *viz.*, the Timli village and its outlying hamlet, Jharbeli, the former situated on the Saháranpúr-Chakráta military road. The entire area is an open reserve.

All the villages given in the list on page 33 possess the concessions referred to on page 5, but only the undermentioned are situated sufficiently near to be able to profit by them :—

Name of village.		Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
Áduwála	...	50	190	8	...
Sháhpúr	...	25	170	...	...
Dharmáwála	...	40	50	...	...
Timli and Jharbeli	...	65	246	22	250
Májri	...	10	150	...	...
Jatonwála	...	40	30	...	...
Tiparpúr	...	...	40	...	...
Sabháwála	...	45	290	...	...
Kaliánpúr	...	4	32	...	...
Total	...	279	1,198	30	250

The Saháranpúr-Chakráta road, inclusive of a belt of 40 feet on each side, is under the control of the Military Works Branch of the Public Works Department.

Small areas of private sál forest and extensive private grazing grounds adjoin the northern boundary.

Configuration and Aspect.—With the exception of a hilly belt from three-quarters to one mile wide along the water-shed line, the whole area consists of flat land sloping gently north-eastwards and cut up by numerous ravines and water-courses, and descending abruptly near the western half of the northern boundary into the immediate valley of the Ásan. The hilly portion is rather steep and very much broken up by small spurs and short gullies, which cause local modifications of the generally northerly aspect. The highest point is, at the western extremity, 3,140 feet above the sea, while the lowest point is about 1,400 feet at the north-western extremity, a maximum difference of level of more than 1,700 feet, but the greater portion of the area is below 2,200 feet.

Soil and Geological Formation.—In the hilly portion the soil is generally poor and sandy, often quite absent and exposing the underlying sandstones and conglomerates. Along the northern boundary, where the plateau descends into the immediate valley of the Ásan, red clays crop out, which form a soil unsuitable for sál. Between the outcrop of these clays and the hilly ground the soil is a sandy loam generally excellent for sál, except where the underlying deposit of shingle and boulders is close to the surface or has solidified into a hard conglomerate. Everywhere on the loamy soils the growth of grass is heavy.

Stock and Area.—The aggregate areas covered by the different types of forest growth are as follows:—

	Acres.
A.—Sál more or less pure	10,711
B.—Mixed sál with sain	1,677
C.—Mixed sál without sain, but with inferior timber trees ...	426
D.—Mixed sál with inferior species alone	3,125
I.—Mixed chir	8
L.—Mixed bamboos	38
N.—Scrub	1,951
P.—Grassy blanks	267
Q.—Unproductive	1,501
Total ...	19,704

The following is the estimated total quantity of standing stock:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above							
	3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound.	Sound.	Unsound	
Sál	438,334	438,544	145,100	16,087	9,175	1,230	2,230	1,050,700
Sain	12,556	21,995	6,266	2,011	748	165	149	43,890
Chir	631	661	661	88	...	34	...	2,075
Inferior timber trees ...	128,032	132,162	38,708	4,003	1,895	1,329	1,358	307,487
Inferior trees	187,221	89,973	19,713	1,445	...	...	...	298,352
Bamboos	875	...	...	...	...	...	...	875
Total ...	767,649	683,335	210,448	23,634	11,818	2,758	3,737	1,703,379

The main crest of the Siwáliks is thinly covered with an open scrub which, with the exception of about two miles, for which length sál comes right up to the water-shed line, consists chiefly of inferior species that are fit only for fuel. Chir is found at the eastern extremity. This belt of scrub is on an average about half a mile wide. Below it comes a belt of mixed sál, which may be divided into minor belts, according as the majority of the associated species are timber trees or only fit for fuel. The development of these sub-belts is very variable, but, as a rule, type C is met with above type D, which does not, however, always form a continuous belt, as, for instance, in the middle of the tract where the other sub-belt alone intervenes between the open scrub and the expanse of more or less pure sál below. This last type extends right down to the lower boundary of the forest, except where the red clay comes to the surface and keeps out sál, admitting chiefly a low, unhealthy growth of inferior species.

On the whole, the vegetation of sál is good The size and the vigour of the trees improve with the distance from the Jamna, being excellent for the Dún at the eastern extremity. Similarly, the density of the forest and the abundance of reproduction of the better species, particularly sál, also improves with the vegetation of the trees. A few miserable, very much over-cut bamboo clumps are found in the hilly portion at the western end of the forest. A very large quantity of material can come out of this forest with much benefit to the young stock.

Recent History.—Measures for the protection of this forest from fire have been undertaken for the first time during the current year.

There have been heavy fellings made in this forest within the last quarter century, but none since it has come under the control of the Forest Department. A certain width of the flat ground near the northern boundary has been at some time or other cleared, probably for cultivation, and owing to constant heavy grazing it is still mere open grass land. Up to about a mile above the lower boundary the grazing is heavy; beyond that distance its effects are not visible. Dry trees have always been exported in the form of tors and firewood, and latterly also of scantlings. Since 1880-81, the dead-wood, together with bamboos, grass, and other minor produce, has been annually leased to the highest bidder at the regular auction sales.

Accessibility.—At present, most of the produce goes out of the Dún by the Chakráta-Saháranpúr road, but in the event of large timber operations coming round here, most of the sawn timber will certainly be exported by the Jamna. Every point below the hills is accessible to carts, and even from the hills themselves the small quantity of produce they can yield can be carried out at profitable rates.

Component Blocks.—The entire area has been divided into the four blocks, the description of which follows, *viz.*, Sháhpúr, Badripúr, Májri and Sabhá-wála.

THE SHÁHPÚR BLOCK.

Situation and Concessions.—This block is the most westerly portion of the Timli Forest, and is separated from the rest of the area by the Saháranpúr-Chakráta road. On the north, it is conterminous with the private lands of Sháhpúr and Dharmáwála, and a part of its eastern boundary marches with that of Timli. On the other side of the Siwálik water-shed line is the Bádsháhi Bágh block of the Saháranpúr Division.

Configuration and Aspect.—The hilly belt is only three-quarters of a mile wide, and the flat ground below, from one and half to four miles long, forms a plateau ending abruptly near the northern boundary, with sides about 100 feet high.

Soil and Underlying Rock.—Except in the hilly portion, where the soil is stony and dry, fairly rich and deep loams prevail everywhere, and good sál may be grown on the greater portion of the area.

Area and Stock.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure	2,524	The greater portion of the flat ground.
B.—Sál mixed with sain	116	Several patches in the lower Siwáliks, intermixed with C.
C.—Mixed sál without sain, but with inferior timber trees	129	Several patches in the lower Siwáliks, intermixed with B.
D.—Mixed sál with inferior species alone	752	Intermediate belt between A, B, and C below and N. above.
L.—Mixed bamboos	38	Mainly two patches in the preceding belt.
N.—Scrub	816	Narrow belt along main watershed line, and an extensive patch on the stiff dry soil near the lower boundary.
Q.—Unproductive	229	
Total	4,604	

Sál appears just below the main water-parting, and descends right down to the lowest point of the block. It is, however, all but absent at the north-eastern extremity on the very broken ground where the plateau ends, and in the hilly portion above, it is largely mixed with other species, and with bamboo in two small patches. Numerous open places occur in the forest, but the vegetation of sál is, on the whole, very fair, the trees attaining an average height of about 45 feet. Sain is very scarce in the block.

Below the hilly ground sál reproduction is fairly good, but is very backward elsewhere.

Recent History.—Nothing special to record.

Accessibility.—Carts can circulate freely through more than three-fourths of the block. The Saháranpúr-Chakráta military road forms its eastern boundary, and its average distance from the Jamna is under eight miles.

THE BADRIPÚR BLOCK.

Situation and Concessions.—This block lies between the Sháhpúr block, from which it is separated by the Saháranpúr-Chakráta road on the west, and the Májri block, separated from it by the Konthronwála rau, on the east; on the north its boundary marches with that of Dharmáwála, Partítpúr, Badripúr and Mednipúr. The private lands of Jharbeli are enclosed in it, and the greater portion of Timli is wedged inside it. On the south, on the other side of the Siwálik water-shed line, are the Chhapri, Khaironwála and Barkala blocks of the Saháranpúr Division.

Configuration and Aspect.—In configuration this block resembles Sháhpúr, but little hills rise above the flat ground near Timli and Jharbeli, and there are larger expanses of flat ground. Moreover, the drainage runs more directly northwards, and in the hilly portion the general aspect is for the most part northerly. The elevation above the sea ranges between 3,000 and 1,500 feet, but more than three-fourths of the area are below 2,400 feet.

Soil and Underlying Rock.—The soil resembles that in the preceding block, and the red clay crops out along the entire northerly boundary.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure ...	4,160	The greater portion of the area, except a belt about half a mile wide along the northern and southern boundaries.
D.—Mixed sál with inferior species alone.	276	A narrow belt along the lower Síwálik slopes.

N.—Scrub	...	... 869	Mainly a narrow belt along the main water-parting with another much broader one on the very broken ground and stiff dry soil along the lower or northern boundary.
P.—Grassy blanks	...	... 51	
Q.—Unproductive	...	... 494	
Total		... 5,850	

The stock resembles that of the Sháhpúr block, with the following exceptions: (i) The belt of inferior species along the northern boundary is continuous; (ii) the belt of inferior scrub along the Siwálik water-shed line is narrower, and outcrops of it appear lower down; (iii) the belt of mixed sál is also narrower; (iv) consequently the type of more or less pure sál has a much wider extension. In the hilly portion, chir appears scattered here and there, and in mixed sál forest there are a few small patches containing bamboo. As a rule the stock is denser and better grown than in the preceding block, the sál often attaining a height of 70 feet and upwards. Sándhan is found everywhere, but chiefly in the lower hilly portion. Climbers, principally máljhan, are abundant in places.

The reproduction of sál is good almost everywhere.

Recent History.—Grazing is rather heavy in the lower half the block.

Accessibility.—Cart and other tracks are numerous; that from Pírwála to the Timli Pass being used as a main thoroughfare. Almost every part of the forest is accessible to carts.

THE MÁJRI BLOCK.

Situation and Concessions.—This block is between the Badripúr block on the west and the Sabháwála block on the east, the intervening natural lines being respectively the Konthronwála and the Sahensra raus. On the north the private lands of Májri, Jatonwála, Tiparpúr and Sabháwála adjoin it, and on the south, on the other side of the Siwálik water-shed line, lie the Barkala and Kusumri blocks of the Saháranpúr Division.

Configuration and Aspect.—The hilly portion at the upper end of the block is about a mile wide, and is very steep and rugged. Below this the ground slopes away gradually northwards to the bank of the Asan river, there being no plateau land as in the two preceding blocks. The highest point is at the south-eastern, and the lowest at the north-western corner, their altitudes being respectively 3,030 feet and about 1,550 feet, thus giving a maximum difference of level of about 1,500 feet; but the greater portion of the area is below 2,400 feet.

Soil and Underlying Rock.—As in the two preceding blocks, but without the stiff clay so conspicuous along the lower edge of the plateau in those blocks.

Stock and Area.—The area is stocked as follows:—

		Acres.	
A.—Sál more or less pure	...	4,027	Nearly the whole of the flat ground.
C.—Mixed sál without sain, but with inferior timber trees	...	297	Chiefly the lower slopes of the Siwáliks.
D.—Mixed sál with inferior species alone		304	Do. middle Do.
N.—Scrub	...	... 255	Do. upper Do.
P.—Grassy blanks	...	... 145	Mainly a large old clearing along part of the lower or northern boundary.
Q.—Unproductive		... 512	
Total		... 5,540	

With the exception of about 10 acres in the north-western corner, which is similarly stocked to the adjoining portion of the preceding block, and a long strip

of grass land (the result of former cultivation) along the northern boundary, there are four distinct types of forest growth. The first is a continuous belt, about a quarter of a mile wide, of inferior open scrub. Sál appears immediately below this, and forms the basis of the three remaining types, the highest forming a continuous belt in which the associated species are chiefly fit for fuel only; the second, not extending across the block, and containing the less valuable timber trees mixed with sál; and the third, occupying five-sixths of the total area of the block, being more or less pure sál. The forest is rather open for about half a mile along the northern boundary. Elsewhere the sál area is fairly densely stocked. The vegetation of the trees is perhaps slightly better than in the preceding block. Climbers actually doing damage are not abundant. Sál reproduction is generally excellent, except in the heavily grazed portions along the northern boundary.

Recent History.—As already mentioned, grazing is very heavy in the vicinity of the private lands.

Accessibility.—In itself this block is even more accessible than Badripúr, but it is of course further removed from the Saháranpúr-Chakráta road and the Jamna.

THE SABHÁWÁLA BLOCK.

Situation and Concessions.—This block is the most easterly portion of the Timli Forests. Its eastern and western boundaries are respectively the Súkh and Sahensra raus On the north it adjoins the private lands of Sabháwála and Kaliánpúr; and on the south the Kusumri and Sahensra Blocks of the Saháranpúr Division.

Configuration and Aspect.—The upper two-fifths of the block are in the Siwáliks, the ground there being generally very irregular, broken, and steep. Below this the surface resembles the flat portion of the preceding block. The heights are about the same.

Soil and Underlying Rock.—As in the preceding block, but rather better suited for sál.

Stock and Area.—The area is stocked as follows:—

	Acres.	
B.—Sál mixed with sain ...	1,561	Nearly all the ground below the hills.
D.—Mixed sál with inferior species alone	1,793	Nearly the entire hilly portion.
I.—Mixed chir	8	Patches along the main water parting.
N.—Scrub	11	Narrow strips wedged inside D.
P.—Grassy blanks	71	Principally near the boundary.
Q.—Unproductive	266	
Total ...	3,710	

In this block the upper two types referred to in the preceding block are all but absent, so that sál is spread almost all over the area, it being mixed over two-fifths of it with inferior timber trees, while elsewhere it contains a certain proportion of sain. As in the preceding block, a strip of grass land exists along the northern boundary. This block is one of the best stocked and most promising portions in the whole Dún. Advance growth of sál, except near the northern boundary, is very abundant and vigorous.

Recent History.—As in the other blocks of the same forest, grazing is very heavy along the northern boundary.

Accessibility.—On the flat ground, export is extremely easy. For the hill portion, which is equal to nearly half the total area, special roads, the construction of which will not however be difficult, will have to be made.

THE SHERPÚR FOREST.

Situation and Concessions.—This forest is situated beween the Timli Forest on the west and the Chandarbani Forest on the east, the dividing natural features being respectively the Súkh and the Khajnaor raus. On the north its boundary marches with those of the following private lands: Kaliánpúr, Hasanpúr, Sherpúr, Shíshambári, East Hopetown, and Malhán. On the south it adjoins Sahensra, Kotri, Káluwála, Sháhjahánpúr, and Khajnaor blocks of the Saháranpúr Division.

The following concession-holding villages are situated near enough to exercise the privileges allowed them :—

Name of Village	Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
Sabháwála	... 45	290	...	...
Kaliánpúr	... 4	32	...	...
Hasanpúr	... 4	50	...	...
Sherpúr	... 15	90	...	...
Shíshambári	... 3	340	...	...
Pelion	... 10	250	...	...
Malhán	... 18	260	...	...
Total	... 99	1,312	..	...

The Khajnaor Pass is always to be kept open.

No private wooded land of any extent adjoins.

Configuration and Aspect.—The Siwálik belt has a width of about a mile and a half, but in the eastern fourth of the area, hilly ground, with large stretches of plateau, land extends right down to the lower boundary line. The configuration of the true Siwálik area presents an extremely confused labyrinth of ridges, spurs, ravines, and gullies, with slopes breaking off in sheer drops, while the hilly ground below it consists of plateaux of larger or smaller extent, the sides of which are very rugged, irregular slopes. All the flat portion is merely a repetition of the flat ground described in the Timli Forest. The drainage everywhere runs slightly east of north into the Ásan.

Soil and Geological Formation.—The soil is nearly everywhere a sandy loam; shallow, sometimes absent, always very dry on the slopes and spurs of the Siwáliks and on some portions of the undulating and broken ground to the east below; elsewhere generally deep and fertile and excellent for sál. The crop of grass is heavy everywhere in the good soil. The predominating rock is sandstone with occasional alternations of conglomerate. Red clay or shale crops out in places in the hills.

Stock and Area.—The aggregate areas under the various types of growth are as follow :—

	Acres
A.—Sál more or less pure	7,504
B.—Mixed sál with sain	1,301
C.—Mixed sál without sain, but with inferior timber trees ...	2,953
I.—Mixed chir timber trees	18
N.—Scrub	746
P.—Grassy blanks	388
Q.—Unproductive	1,012
Total ...	13,922

The quantity of stock is thus estimated :—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above 3" and up to 6"	Diameter above 6" and up to 12"	Diameter above 12" and up to 18"	Diameter above 18" and up to 24"		Diameter above 24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sál	350,290	365,043	83,412	11,330	2,778	1,528	1,739	816,120
Sain	13,594	24,898	7,124	1,583	148	99	18	47,464
Chir	829	948	722	186	...	30	...	2,715
Inferior timber trees ...	107,868	102,222	14,383	3,638	589	262	387	229,349
Inferior trees	95,690	54,841	3,538	30	...	...	...	154,099
Total ...	568,271	547,952	109,179	16,767	3,515	1,919	2,144	1,249,747

This is an extremely valuable forest, and is certainly the most valuable and promising in the Western Dún. Nearly every portion of the area produces sál, and at least one half of it can grow sound trees of that species from 80 to 100 feet high, with a straight, clean, well-shaped bole. All the flat ground is occupied by more or less pure sál, and sain grows in considerable numbers on the lower hilly ground in the middle of the area. Chir is found along the entire water-shed line, and is abundant, vigorous, and well-grown for the Dún. Several glades and grassy blanks exist, the result of former clearings made chiefly for cultivation; but these are gradually filling up, and it will not be difficult to reclothe them, if necessary, with sál.

Accessibility.—Most of the wood and minor produce is exported from this forest to Dehra and the surrounding villages. But some of this is sold at Dehra to outsiders. The quantity extracted has not yet been large enough for any part of it to find its way down the Jamna. A portion goes out directly by the Mohand Pass, and more would go out that way if a good cart track connected the middle of the forest with Asárori.

Component Blocks.—The Sherpúr Forest comprises three blocks, *viz.*, Kaliánpúr, Káluwála and Malhán.

The Kaliánpúr Block.

Situation and Concessions.—This block forms the western extremity of the forest, being separated from the Káluwála block by the Bhúl rau. On the north its boundary marches with those of Kaliánpúr, Hasanpúr, and Sherpúr, and on the south it adjoins the Sahensra Block of the Saháranpúr Division.

Of the privileged villages, only the following four are situated within a convenient distance to exercise their concessions in this block: Sabháwála, Kaliánpúr, Hasanpúr, and Sherpúr.

Configuration and Aspect.—In these respects this block resembles the adjoining Sabháwála block of the Timli Forest, only the proportion of flat to hilly ground is somewhat larger, and the former is more undulating, while two large raus, both bearing the name of Bhainsi rau, traverse its entire length.

Soil and Underlying Rock.—As in the adjoining Sabháwála block, except that the soil near the main water-shed line is generally of an inferior description.

Stock and Area.—The area is stocked as follows :—

	Acres.	
A.—Sál more or less pure	2,900	Most of the area below the hills.
C.—Mixed sál without sain, but with inferior timber trees.	1,574	All the hilly portions, except a narrow, but not continuous, belt along the main water-parting.
I.—Mixed chir	18	Patches along the main water-parting and crests of the larger spurs.
N.—Scrub	137	The narrow belt referred to under C.
P.—Grassy blanks	141	Chiefly a long strip along lower boundary line.
Q.—Unproductive	345	
Total ...	5,115	

The stock is generally a slightly improved variety of the stock in the Sabháwála block, the trees being generally healthier and sounder, and the reproduction somewhat more advanced.

Recent History.—The same as that of the Sabháwála block.

Accessibility.—As regards export, this block resembles the Sabháwála Block.

The Káluwála Block.

Situation and Concessions.—This is the central of the three blocks composing the Sherpúr Forest, and is separated from the Kaliánpúr block on the west by the Bhúl rau and from the Malhán block on the east by the Rámgarh rau. On the north it adjoins the private lands of Sherpúr and Shíshambári ; and on the south the Kotri and Káluwála blocks of the Saháranpúr Division. The following five privileged villages are within convenient reach of this block :—

Hasanpúr, Sherpúr, Shíshambári, Pelion, and Malhán.

Configuration and Aspect.—Similar to that of the preceding block.

Soil and Underlying Rock.—On the whole, the rock and the soil are both slightly better for the growth of sál than in the preceding block.

Stock and Area.—The area is stocked as follows :—

	Acres.	
A.—Sál more or less pure	2,813	Most of the ground below the hills.
B.—Mixed sál with sain	1,301	Chiefly in the western hilly portion.
C.—Mixed sál without sain, but with inferior timber trees.	788	East of the preceding type.
P.—Grassy blanks	150	Several patches, principally near the lower boundary.
Q.—Unproductive	447	
Total ...	5,499	

The stock is superior to that of the preceding block, and is perhaps the best in the Western Dún. Sál is found everywhere right up to the main watershed line, and in the western portion of the hilly belt sain is fairly abundant. On the other hand, chir is rare. The advance growth of sál is generally most excellent.

Recent History.—The same as that of the preceding block.

Accessibility.—As regards export, there is very little difference between this and the preceding block.

THE MALHÁN BLOCK.

Situation and Concessions.—This is the most easterly portion of the Sherpúr Forest. On the north it is conterminous with the private lands of East Hopetown and Malhán; and on the south with the Sháhjahánpúr and Khajnaor blocks of the Saháranpúr Division. Of the privileged villages, only the three following are within easy reach of the block :—

Shíshambári, Pelion, and Malhán.

Configuration and Aspect.—With the exception of flat ground near the Rámgarh rau, on each side of the Aughipáni rau, and along the lower branches of the Khajnaor rau, the block consists of rugged, hilly ground for half-way down from the main water-shed line, and elsewhere of undulations and plateaux of limited extent, with rough, often steep, sides. Thus, although the general fall of the ground is northwards, the local aspects are extremely varied. The Aughipáni rau runs through the middle of the block, and is separated from the Rámgarh and Khajnaor raus by the undulating ground and plateaux just referred to.

Soil and Underlying Rock.—The soil is a sandy loam, overlying principally sandstones. Near the main watershed line it is very dry and poor; elsewhere it is very fertile, excellent for sál, and bears a tall crop of grass.

Stock and Area.—The area is stocked as follows :—

	Acres.	
A.—Sál more or less pure	1,791	Confined chiefly to the flat ground, except in the basin of the Aughipáni rau, where it runs up into the Siwáliks.
C.—Mixed sál without sain, but with inferior timber trees	591	In several patches on the lower Siwálik slopes, and on the undulating ground.
N.—Scrub	609	Mainly the upper slopes up to the main water-parting.
P.—Grassy blanks	97	Several patches, the largest near the northern boundary.
Q.—Unproductive	220	
Total ...	3,308	

Along the main water-shed line chir is fairly numerous, healthy, and of large size for the Dún. Surrounding the chir, and extending for half-a-mile downwards, comes the belt of scrub which is composed principally of inferior species, with a miserable sál here and there. Below this, sál begins to flourish, but is more or less pure only on the flat ground, being nearly everywhere else mixed with inferior species. It is slightly above the average for the Dún as regards size, vigour, and quality. Advance growth of sál is plentiful, and the sál-bearing area is fairly densely stocked.

Recent History.—The same as that of the other two blocks.

Accessibility.—Owing to the broken nature of the ground, numerous export paths and tracks will have to be made. The average distance to the Jamna is 21 miles, and to the Dehra-Saháranpúr road 9 miles.

THE CHANDARBANI FOREST.

Situation and Concessions.—This forest is the extreme eastern portion of the Government forests of the Western Dún, being situated between the Khajnaor rau, separating it from the forest just described, on the west, and the Saháranpúr-Dehra road on the east. On the north it adjoins the private lands of Malhán, the Carberry Grant, East Hopetown, Harbhajwála, Mihunwála, the Dehra Dún Tea Company's Estate, Chandarbani, and Asárori; and on the south the Khajnaor and Mohand blocks of Saháranpúr. Large areas of grass and scrub adjoin this

forest and the Dehra Dún Tea Company possesses about 400 acres of fairly good sál forest.

Of the villages which are allowed to graze a fixed number of cattle at half rates, and remove, free of payment for their own use, head-loads of fuel and minor produce, the following are situated near enough to avail themselves of this privilege in the Chandarbani Forest :—

Name of village.	Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
Malhán ...	... 18	260	...	...
Carberry Grant ...	... 8	100	...	...
Harbhajwála ...	... 15	300	...	...
Mihunwála ...	... 50	300	4	60
Pithuwála ...	... 10	40	...	...
Májra ...	... 50	225	10	...
Sheola Kalán ...	... 50	260	...	...
Sheola Khurd ...	... 8	60	...	...
Mohabbáwála ...	... 26	50	...	...
Kaunli with Harípúr	... 60	300	10	260
Total	... 295	1,895	24	320

But the portion of the forest enclosed between the outer boundary of the forest, the Hátiwála road and the upright road joining the former road with the Karwápáni Bungalow, has, with the sanction of the Collector, been closed since 1887 against the exercise of this privilege, although grazing is allowed from the commencement of the south-west monsoon till the end of December, or such date as the Divisional Officer may determine. The Asárori and Khajnaor Pass roads are not to be closed, and the Dehra Dún Tea Company, and the East Hopetown and Carberry Grants are allowed the exclusive use of the water in the streams.

Configuration and Aspect.—The hilly belt of the Siwáliks is little more than a quarter of a mile broad, except in the eastern portion of the forest where indeed it extends, in one place, right down to the lower boundary line. The general fall of the ground is northwards, but in the broad, hilly portion the numerous long spurs produce rapid local variations of aspect. The gradients of the slopes are very various, but the average is about 20°. In the rest of the forest the ground consists of numerous plateaux, the majority of which run down to the lower boundary line and are separated from one another by narrow ravines and the main water-courses.

The elevation above the sea ranges from 2,800 to 1,950 feet, the maximum difference of level being only 850 feet, but even here the greater portion of the area is below 2,400 feet.

Soil and Geological Formation.—The entire hilly portion is composed of sandstones and conglomerates of various degress of hardness, with interbedded red and brown clays, which determine the frequently strongly clayey nature of the soil there. Below this the soil is a sandy, generally fertile, loam, but still containing a large quantity of clay, especially in the western half, where sain is able to appear in large numbers. Here the underlying rock is generally the usual deposit of shingle and boulders, which in many places has hardened into a conglomerate. Everywhere the soil is suited for sál, which can attain first-class size throughout the area below the hills and on the lower plateaux in the hilly portion in the eastern part of the forest. Except on the slopes of the Siwáliks, the growth of grass, and low brushwood composed of *Randia*, *Indigofera*, and karaunda, &c., is dense. The Karwápáni and Mánaksidh raus have running water in them in the lower part of their course throughout the year, and the Láldháng rau also flows for many months after the rains, and contains drinking water in places all the year round.

Stock and Area.—The various types of forest growth are represented as follows:—

	Acres.
A.—Sál more or less pure	4,017
B.—Mixed sál with sain	1,926
D.—Mixed sál with inferior species alone	740
N.—Scrub	10
P.—Grassy blanks	239
Q.—Unproductive	357
Total ...	7,289

The subjoined statement contains an estimate of the present standing stock:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.	Remarks.
	Diameter above 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"			
				Sound.	Unsound.	Sound.	Unsound.		
Sál	147,813	101,138	83,040	12,491	4,899	817	1,357	351,555	
Sain	17,512	18,659	10,981	2,025	861	371	312	50,721	
Chir	367	488	405	162	...	41	...	1,463	
Inferior timber trees ...	33,363	32,937	11,727	1,929	1,358	251	243	81,808	
Inferior trees ...	36,757	41,347	4,011	375	...	...	...	82,490	
Totals ...	235,812	194,569	110,164	16,982	7,118	1,480	1,912	668,037	

The forest consists mainly of sál, which is mixed with inferior species on most of the Siwálik slopes and on some of the patches of inferior soil lower down, and with sain over the greater portion of the western half of the area.

The density of growth, taking the forest as a whole, increases with its distance from the Mohand-Dehra road and from Dehra. The growing stock is chiefly young, the few trees of any size which are met with being undoubtedly those which were already unsound or deformed when lessees and their army of destroyers roamed free over the forest in pre-Department days. The advance growth of sál and sain is very abundant and promising, especially in the area north of the Hátiwála road, where the soil is so much more favourable than elsewhere. Climbers are abundant on the lower slopes of the hills and in the richer soils. On the whole, in spite of longer fire-conservancy, this forest is neither so good nor so promising as the preceding forest (Sherpúr).

Recent History.—The portion of the forest below, *i.e.*, north of the Hátiwála road, has been under fire protection since 1882.

There can be no doubt, seeing the proximity of Dehra and the Dehra-Mohand road, that this forest was heavily worked before it came under the control of the Forest Department, and that it now requires a thorough renewal of the stock.

In the fire-conserved area, grazing is allowed from the commencement of the rains to the end of December or any later date fixed by the Divisional Officer, during which period it is rather heavy near the northern boundary. In the open forest, grazing is very heavy in the neighbourhood of Asárori, whence also a large quantity of fodder and thatching grass is removed, both for local consumption at the dâk gari stables at Asárori, and for export.

Accessibility.—All the most productive parts of the forest (nineteen-twentieths of the total area) are easily accessible to carts, but a few good forest roads are still required. The small produce from this forest is exported principally to Dehra and the intervening large villages. Most of the large logs, scantlings, and other superior classes of produce are exported out of the Dún, either by the Mohand Pass road, or, as happened in 1885, by way of the Jamna.

Component Blocks.—The Chandarbani Forest consists of the following two blocks—(1) Mánaksidh and (2) Láldháng:

THE MÁNAKSIDH BLOCK.

Situation and Concessions.—This block forms the western portion of the Chandarbani Forest, and is separated from the Láldháng block by the Bánga rau. On the north, its boundary marches with those of Malhán and the Carberry Grant; and on the south it touches the Khajnaor and Mohand blocks of the Saháranpúr Division. The Khajnaor Pass road runs through this block, and the exclusive use of the water in the Karwápáni and Mánaksidh raus is allowed to the Carberry and East Hopetown Grants. Of the privileged villages, only the following two are situated within convenient distance of the open portion of the block to profit by the concession—Malhán and the Carberry Grant.

Configuration and Aspect.—The hilly belt of the Siwáliks in this block is barely more than a quarter of a mile broad, and consists chiefly of a uniform succession of small spurs running down northwards, the gradients ranging from 15° to 40°. Below this, the ground forms a large, gently sloping plateau, intersected by numerous water-courses, all converging northwards towards the Ásan river; but at the northern extremity the area also includes about 100 acres lying at the foot of the plateau. The elevation above the sea ranges between 2,700 and 1,950 feet, but nine-tenths of the area are below 2,300 feet.

Soil and Underlying Rock.—There is fairly good soil nearly everywhere. In the hilly portion it is a reddish brown clay, containing shingle and rolled stones, and resting principally on sandstones and conglomerates, and here and there, over limited areas, on bands of ferruginous clay. Below the Siwáliks the soil is a sandy loam, generally deep and rich, and excellent for sál. In many places it is covered with a dense tall growth of grass, with a very large proportion of small shrubs. There is running water all through the year in the lower course of the Karwápáni and Mánaksidh raus; and water is probably nowhere very far from the surface below the Hátiwála road.

Stock and Area.—The area is stocked as shown below:

	Acres.	
A.—Sál more or less pure	1,547	Along both sides of the Hátiwála road, and in the flat triangular area between the Gúlarwála and Bánga raus.
B.—Mixed sál with sain	1,926	Most of the remainder of the area below the hills.
D.—Mixed sál with inferior species alone	526	Principally the hilly portion.
N.—Scrub	10	A patch in the south-eastern corner.
P.—Grassy blanks	146	Several patches in the lower portion of the block.
Q.—Unproductive	193	
Total ...	4,348	

Sál is found abundantly over the whole block, and in all the central portion it is mixed with a large proportion of sain. On the whole, the stock is fairly dense and the vegetation is vigorous. The reproduction of both sál and sain is excellent, and is making rapid progress. In every respect this block is much better than the next one (Láldháng).

Recent History.—The whole area below the Hátiwála road has been under fire conservancy since 1882.

Accessibility.—Almost every portion of the area is easily accessible to carts. The two roads from the Karwápáni Bungalow, one going southwards towards the Siwáliks, the other south-eastwards to meet the Hátiwála road, coming from Asárori, are excellent. The gradients of the Hátiwála road require improving at the ravines.

THE LÁLDHÁNG BLOCK.

Situation and Concessions.—This is the eastern portion of the Chandarbani Forest, and lies directly on the Mohand-Dehra road. Its lowest boundary abuts against the private lands of the Carberry Grant. East Hopetown, Harbhajwála, Mihunwála, the Dehra Dún Tea Company's Estate, the Chandarbani Grant and the Nahán Rája's Zamindári forest of Asárori. The exclusive use of the water in the streams in this block is allowed to the Dehra Dún Tea Company.

Of the privileged villages, only Harbhajwála, Mihunwála, Pithuwála, Májra, Sheola Kalán and Khurd and Mohabbáwála are situated near enough to exercise to the full the concessions granted to them by administrative order.

Configuration and Aspect.—The portion of the block above the Hátiwála road (more than one-third of the entire area) is hilly, but contains some expanses of plateau land, all the rest being extremely rugged and cut up by numerous deep ravines and gullies. The ground here falls to the north or north-east, but numerous variations of easterly and westerly aspects prevail, due to the many spurs which run out in various directions. The portion below the Hátiwála road, which forms for the most part a long rectangle abutting southwards on the Ásan, is remarkably flat, but intersected, particularly near the southern extremity, by numerous deep ravines and water-courses. The highest point of the block is about 2,800, the lowest about 1,900 feet above the sea. The average level of the Hátiwála road is about 2,300 feet.

Soil and Underlying Rock.—The soil is a clayey or sandy loam, the proportion of clay generally increasing towards the hills, where numerous bands of clay are interbedded with the sandstones and conglomerates forming the body of the hills. The soil is on the whole excellent for sál.

Stock and Area.—The ground is stocked as follows :—

	Acres	
A.—Sál more are less pure ...	2,470	The greater portion of the area right up to the main water-parting.
D.—Mixed sál with inferior species alone ...	214	Various patches, both on level and hilly ground.
P.—Grassy blanks ...	93	Several patches principally in the lower portion of the block.
Q.—Unproductive ...	164	
Total	2,941	

Owing to the nearer neighbourhood of this block to population and to a first class Public Works road, it has suffered more than the previous one from over-cutting, and hence consists in many places, more especially along the northern boundary line, chiefly of a crop of poles of sál more or less pure. A considerable proportion of the larger trees everywhere is crooked and unsound. The growth is also generally very open. Sál is found everywhere, and, with the exception of a few limited patches where the soil becomes a little too clayey for it, exists more or less pure. Sain is represented only on a small scale. Chir is found scattered along the water-shed line, but shows a vigorous vegetation for the Dún. In the southern extremity of the block patches of grass-land are met

with in low-lying places. Advance growth of sál is very abundant almost throughout the block, and is very promising. North of the Hátiwála road it has been kept back by the annual fires, and, in the vicinity of the Mohand road, also by heavy grazing.

Recent History.—The lower portion, although closed forest, is heavily grazed over during the open season, chiefly by cattle which are kept for the night at Mihunwála. As already said, grazing is heavy in the open portion near Asárori, and large quantities of fodder, as well as thatching grass, are removed thence. Improvement fellings have already been carried out over 1,440 acres, 628 acres having been operated upon in 1884-86, and 812 acres in 1885-87. Trees have been marked for felling during 1887-89 over the remainder of the block, north of the Hátiwála road. The two completed coupes realised Rs. 32,476 net from the sale of 11,845 sál and 2,600 sain trees and poles of sizes, of which only 16 per cent. exceeded 18 inches in girth.

Over the 628 acres of the improvement coupe of 1885-86 cleanings have been made, and all unpromising sál and sain saplings and small poles have been cut back.

Accessibility.—With the exception of a belt, half a mile wide, along the upper line of the Siwáliks, which it would be difficult to render accessible to carts, export from this block is easy enough. Numerous roads connect it with the populated tract below, and all converge either on Dehra or the Dehra-Mohand road.

RÁMGARH FOREST.

Situation and Concessions.—This forest, the most westerly portion of the reserved forest area in the Eastern Dún, lies between the Súswa and the main watershed line of the Siwáliks. On the north, the Dehra-Mohand road separates it from the Chandarbani Forest, and it also adjoins the Asárori Zamindári Forest and the villages of Telpura and Bhánúwála. On the east it touches the Nágsidh Forest from pillar 42 to 43, and has the following villages interposed between it and that forest:—Mothronwála, Muhammadpúr (Muhammadpúr and Khairi) Phándonwála (Mahant-ki-Khairi) and Dúdhli. On the south lies the Bulláwála Forest, and on the west, on the other face of the Siwáliks, the Mohand, Súkh and Chikna blocks of the Saháranpúr Division. The Asárori Forest belongs to the Rája of Náhan, and was only three years ago quite as good as the adjoining State forests, but heavy annual fellings have since been made in it, which, if continued for another four years or so, will result in leaving only a stock of poles on the ground. Telpura and Bhárúwála comprise chiefly grass land with a very open scrub of inferior species. In the remaining adjoining private lands there is next to no wooded area left—even sufficient for the limited requirements of the inhabitants.

No concessions of any kind have been granted in the Rámgarh forest.

Configuration and Aspect.—The Siwáliks attain a great width at the western extremity of this forest, and even at their narrowest point they are nearly two miles broad. They exhibit the extreme character of the chain, irregular spurs and ridges with ravines suddenly sweeping round at right angles, and some of the main feeders of the principal streams flowing in directions most contrary to the general drainage lines. Abrupt ledges formed by slipping of the up-heaved strata, which are so curious a feature of the Siwáliks everywhere, are very common here. The main fall of the ground is to the east, but owing to the very irregular features just noticed every variety of aspect is represented. The lower slopes, however, generally look east. The ground below the hills is generally flat and falls rapidly eastwards towards the Súswa, near which, in the western half of the forest, it drops more or less abruptly into the bed of that river. Thus in this portion the flat ground forms a plateau cut up into long, narrow strips by numerous parallel, branched and deep ravines. The two Súkh raus and the Rewári, Chorpáni, and Phándonwála raus are the larger streams which drain the area, while the Súswa river flows within its south-eastern boundary. The greatest difference of level is 1,250 feet, the highest and lowest points being respectively 2,934 and 1,680 feet, but by far the greater portion of the area ranges between 1,800 and 2,200 feet of altitude.

Soil and Geological Formation.—In the hilly portion the rocks are much more varied than in the Chandrabani Forest; they comprise sandstones and conglomerates of every degree of hardness, with interbedded red and brown clays, which often determine the character of an entire hill-side. As usual, the soil here is shallow, and, owing to the great thickness of the sandstones and conglomerates, the ridges and hillsides are naturally very dry down to a great depth. Below the hills the soil is a sandy loam of excellent quality for sál, except where the underlying rock is a hard, impermeable conglomerate or a band of clay, and the young vegetation consequently suffers from water-logging and insufficient root-aëration. In all places not having a close growth of trees the grass is tall and dense and of a coarse quality.

Stock and Area.—The various types of growth are thus distributed:—

	Acres.
A.—Sál more or less pure	2,318
B.—Mixed sál with sain	4,483
C.—Mixed sál without sain, but with inferior timber trees ...	719
D.—Mixed sál with inferior species alone	895
M.—Miscellaneous timber trees	205
N.—Scrub	687
P.—Grassy blanks	461
Q.—Unproductive	714
Total ...	10,482

The present stock is thus estimated:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sál	239,157	159,301	60,481	11,715	1,976	1,133	939	474,702
Sain	23,465	26,826	9,483	2,332	228	337	87	62,758
Chir	74	55	74	16	...	47	...	266
Inferior timber trees ...	209,974	108,948	13,595	1,815	594	203	247	335,376
Inferior trees ...	280,140	80,848	14,721	3,918	...	...	...	379,627
Total ...	752,810	375,978	98,354	19,796	2,798	1,720	1,273	1,252,729

Sál is met with throughout the area, but in the southern half of the hilly portion it occurs only as miserable scattered trees, while in the northern half, although it is the predominant species, its growth is not at all promising. On the northern face of the lower hills, at every point of the isolated hills below the main mass of the Siwáliks, and almost throughout the flat ground, the forest growth is composed mainly of sál. Here the larger and older trees, *viz.*, those which were not considered good enough to remove by the old lessees and their men, are seldom well-shaped or quite sound; but all the younger growth, especially that portion of it which is contemporaneous with the advent of the Forest Department

is generally extremely promising. Sain is found in considerable numbers in the western portion of the forest. Advance growth of sál, and in certain parts of sain, is generally very abundant and coming on well, except in the south-eastern portion, where the former destruction of the forest, the rank growth of grass, the low and frosty situation, and here and there heavy grazing, make the natural reproduction of the forest a difficult and slow matter. Climbers are abundant and destructive mainly in the south-eastern portion of the forest.

Recent History.—Every portion of the area between the Hátiwála and the Asárori-Rámgarh-Bulláwála roads has been under fire protection since 1879, and the small plantation north of Rámgarh, and the circular areas specially set apart for meteorological observations have been protected since 1883 and 1884 respectively.

Grazing is permitted from the beginning of the rains till the end of January.

Improvement fellings, begun in 1882 and still in progress, have passed through 3,592 acres below the Hátiwála road. The revenue realised from the sale of the sál and sain marked amounts to Rs. 62,481, or just over Rs. 17 per acre. The trees were all sold standing, and 90 per cent. were not more than 18 inches in diameter. Over 1,553 acres of the above area cleanings have been made, and unpromising saplings and small poles of sál and sain have been cut back for an improved regrowth from the stool. The cost of the operation has been Rs. 1,019, or about 11 annas an acre.

One of the two sample acre-plots, kept up for ascertaining the rate of growth of sál and the various other trees in them, is situated at the south-eastern extremity of the forest.

Accessibility.—Nearly every portion of this forest is favourably situated for the export, not only of timber, but also of firewood, grass and other minor produce. At present the firewood and grass finds its way mainly to Dehra, while the timber goes out both to Dehra and to Asárori, from the latter of which places most of it leaves the Dún by the Mohand Pass.

Component Blocks.—Asárori, Muhammadpúr, and Phándonwála.

THE ASÁRORI BLOCK.

Situation.—The Asárori block comprises the northen portion of the Rámgarh Forest, and its northern boundary is, therefore, the same as that of the forest itself. On the east it adjoins Mothronwála and touches the Dúdhli block of the Nágsidh Forest. On the south the Súkh rau separates it from the Muhammadpúr block, and on the west the water-shed line of the Siwáliks separates it from the Mohand, Súkh and Chikna blocks of the Saháranpúr Division.

Configuration and Aspect.—The greater portion of this block is hilly; but, on the other hand, the portion north of the lower third of the Rewári rau, and the road from Bulláwála to Asárori is extremely flat, although cut up into long plateaux by deep, almost parallel ravines. Above the Hátiwála road the ground is very rugged and steep, and composed of the extremely irregular succession of spurs, sudden scarps, ravines, and gullies referred to above under the description of the forest. The consequence of this is that, although the ground falls generally eastwards, there is every variety of northerly, easterly, southerly and westerly aspects, and some of the independent ridges and peaks, standing away from the main water-shed line, are higher than many points of the water-shed line itself. Below the Hátiwála road is a large, isolated hill running west and east, with a much smaller one near Asárori. The highest and lowest points of the block are respectively 2,916 and about 1,800 feet above the sea, the maximum difference of level being thus, in round numbers, 1,100 feet. The general level of the Hátiwála road, which divides the block into almost two equal portions, is about 2,400 feet.

Soil and Underlying Rock.—Generally a rich, sandy loam resting on sandstones and conglomerates of all degrees of hardness. In the hilly portion at the western extremity, however, it is very dry and stony, and at the northern extremity it is very shallow, and rests on a hard bed of conglomerate. The growth of grass is everywhere heavy. With the exception of the portion of bad soil at the northern extremity, sál can be grown all over the block, and attains average

dimensions in most places. Sain also can thrive throughout the middle portion of the block.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure	1,000	Mainly two large patches; one extending for about 1½ miles west from Rámgarh Chauki, the other, much more extensive, occupying chiefly the head of the Rewári rau basin and crossing the water-parting northwards into the basin of the Súkh rau.
B.—Mixed sál with sain	2,133	All the rest of the area below the Hátiwála road, excepting the patch under P, and, in addition, a portion in west above that road.
C.—Mixed sál without sain, but with inferior timber trees.	163	Principally above the Hátiwála road.
P.—Grassy blanks	250	Chiefly a large patch at the northern extremity of the block.
Q.—Unproductive	209	
Total ...	3,755	

At the northern extremity there is chiefly grass land, covering more than 200 acres. Between this and the Rámgarh-Asárori road comes a large stretch of inferior forest, in which the proportion of sál is comparatively small and the trees generally short and mis-shapen. Similar forest, but of even a worse type, is found at the south-eastern extremity of the block. Elsewhere sál predominates, and sain enters into mixture with it in varying, occasionally considerable proportions, especially along the central portion of the block, where the soil becomes strongly clayey. Except in the very hilly ground, the vegetation of sál and sain is promising, and their reproduction is generally very abundant. The upper stage of growth is rather open owing to the recent fellings in the area between the Hátiwála and the Asárori-Rámgarh roads; but to this felling is due the fine appearance of the reproduction which existed as advance growth at the time of the fellings. Scattered chir trees are found along the crest of the Siwáliks, but none of any size.

Recent History.—Improvment fellings passed through 1,636 acres of the block below the Hátiwála road in 1882-86, together with about 400 acres of the Muhammadpúr block, which were worked over simultaneously with it; this area yielded Rs. 38,106 net from the sale of 13,225 sál and 2,772 sain trees of sizes, barely 6 per cent. of these having been more than 18 inches in diameter. Cleanings were made, and injured and otherwise unpromising sál and sain saplings and poles were cut back for improved regrowth from the stool, in 1885-86, over 753 acres out of the total of 1,636. The cost of this operation was Rs. 604.

Accessibility.—Below the Hátiwála road there are numerous excellent kacha forest roads, which render every portion accessible to carts. The Hátiwála road itself has, at present, gradients too steep for carts. The hilly portion above this road contains no made export lines, and is extremely inaccessible.

THE MUHAMMADPÚR BLOCK.

Situation.—This block comprises the central portion of the Rámgarh Forest, being separated from the Asárori block, on the north, by the Súkh rau, and from the Phándonwála block, on the south, by the Khairi road and the right branch of the Phándonwála rau. On the east it adjoins the private lands of Muhammadpúr, and touches the Dúdhli block of the Nágsidh forest at pillar 43, while on the west the water-shed line separates it from the Chikna block of the Saháranpúr Division.

Configuration and Aspect.—The upper two-thirds of the block, most of it lying along the Hátiwála road, is of the same irregular character as the hilly ground in the preceding block. Below this the ground consists of plateaux all trending eastwards, with generally steep sides, and separated from one another by deep ravines. The only large and broad one of these plateaux lies along the Súkh rau. The highest and lowest points are respectively 2,934 and 1,800 feet above the sea, the maximum difference of level being more than 1,100 feet. Some of the ridges running parallel to the main water-shed line are more than 2,700 feet above the sea. Two-thirds of the block are below 2,200 feet above the sea.

Soil and Underlying Rock.—In the greater part of the hilly portion the soil is very shallow, and is stonier and drier than on similar ground in the preceding block. Below this the soil improves suddenly, and becomes a rich, deep, sandy loam, on the whole better suited for sál than the soil on the flat ground in the Asárori block. In the Súkh rau water is at, or close to, the surface at certain points throughout the year. Wherever the tree growth is open, the crop of grass is high.

Stock and Area.—The various types of forest growth are distributed as follows:—

	Acres.	
A.—Sál more of less pure	1,053	Principally all the ground south of the Súkh rau, between Thelwall's line and the Hátiwála road.
B.—Mixed sál with sain	750	The lower slopes in the south with a narrow belt along the Khairi road.
C.—Mixed sál without sain, but with inferior timber trees.	556	On the broken ground below Thelwall's line and on the lower slopes in the north intermixed with the next type.
D.—Mixed sál with inferior species alone...	314	On the upper slopes mixed up with the next type.
M.—Miscellaneous timber trees ...	18	Intermixed with the preceding type.
N.—Scrub	264	
P.—Grassy blanks	21	
Q.—Unproductive	195	
Total ...	3,171	

The dry, stony soil in the hilly portion bears chiefly an open crop of inferior species with scattered miserable sál. Below this comes more or less pure sál forest, the proportion of the inferior timber trees and other species diminishing towards the level ground. The sides of the plateaux overlooking the valley of the Súswa contain a marked proportion of these inferior trees. The greater portion of the stock is quite young, the block having been heavily worked for the large timber it contained before it came under the control of the Forest Department. This young growth is, as a rule, very dense, and is coming on splendidly. Climbers are abundant only on the edges of plateaux and on low slopes.

Recent History.—The entire area between the Hátiwála and the Rámgarh-Bulláwála roads (about 1,620 acres) has just undergone improvement fellings, which began in 1884. In 172 acres along the Súkh rau below Colvin's line, cleanings were made, and unpromising saplings and small poles of sál and sain were cut back for an improved regrowth from the stool in the cold weather of 1886.

THE PHÁNDONWÁLA BLOCK.

Situation.—This block forms the southern extremity of the Rámgarh Forest, being separated from the preceding block by the Khairi road and the lower branch of the Phándonwála rau, and from the Balindawála block of the Bulláwála Forest on the south by the Kishanpúr road and the Balinda rau. On the east it stretches across the Súswa and abuts against the private lands of Muhammadpúr,

Phándonwála, and Dúdhli, while, on the west, it adjoins the Chikna block of the Saháranpúr Division.

Configuration and Aspect.—Owing to the two raus, which form the upper boundary of the block, converging and approaching to within less than half a mile of one another near the main water-shed line, the proportion of hilly ground in this block is comparatively small; but what exists of it resembles similar ground in the preceding block, although the northern lower slopes are generally less steep and rugged. The flat ground is much more open and uniform than similar ground in the preceding block, and it slopes gradually eastwards to the Súswa without any abrupt descent. The Súswa portion consists of numerous islands and channels, and the whole bed of the stream here is, on an average, a quarter of a mile broad. The highest and lowest elevations are respectively 2,934 and about 1,680 feet above the level of the sea, thus making a maximum difference of level of as much as 1,250 feet, but most of the area lies between 2,300 feet and 1,700 feet.

Soil and Underlying Rock—The soil is similar to that in the Muhammadpúr block, but is usually deeper, and although perhaps better adapted for sál, its conspicuous flatness favours the presence of other species.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure	265	Mainly a large patch west of Thelwall's line.
B.—Mixed sál with sain	1,600	Excluding the above patch, nearly the entire area above Thelwall's line up to the foot of the hills.
D.—Mixed sál with inferior species alone	581	Mainly below Thelwall's line.
M.—Miscellaneous timber trees ...	187	The large patch on the lower southerly slopes overhanging the Balinda rau.
N.—Scrub	423	Principally all the upper slopes.
P.—Grassy blanks	190	Patches of various sizes in the lower portion of the block, especially along Súswa.
Q.—Unproductive	310	Includes bed of Súswa.
Total ...	3,556	

The growth in the upper hilly portion resembles that in the similar portion of the preceding block. Below that, sál is found right down to the bank of the Súswa, predominant everywhere, but in most places admitting an appreciable proportion of inferior trees. Sain is not abundant either in the young or old crop. The growth is generally very open, especially in the lower portion of the block, where grassy glades with very poor reproduction abound. This backward condition of the crop is due to very heavy working in former times, to heavy grazing since then in parts, to the extremely flat nature of the ground, to the hard, grass-covered soil and to frost. Climbers are very abundant and destructive.

Recent History.—Improvement fellings are in progress in the portion of the block situated between the Hátiwála and Rámgarh-Bulláwála roads, and north of the Dúdhli road.

This block was no doubt very heavily worked over before it came under the control of the Forest Department, and there are evident signs of there having been population in the lower portions during the preceding generation. No fellings of any kind have been made here since.

Accessibility.—Nearly the whole of this block is extremely accessible to carts, and several very good roads traverse it.

THE BULLÁWÁLA FOREST.

Situation and Concessions.—The forest is situated at an average distance of 14 miles from Dehra, 12 miles from Asárori, and 13 miles from the Ganges, and lies wedged in between the Rámgarh Forest on the north, the Kánsrau forest on the south, and the Chikna, Gáj, Bínj, Dhaulkhand and Máláwála blocks of the

Saháranpúr Division on the opposite face of the Siwáliks on the west. On the east its boundary, inside one-third of which the Súswa flows, marches along the private lands of Nágal and the Markham Grant, and coincides between pillars $\frac{83}{74}$ and $\frac{82}{75}$ with that of the Nágsidh Forest. No rights or concessions of any kind exist.

Configuration and Aspect.—The belt of hilly ground is confined entirely to the Siwáliks, but is fairly broad, being more than a mile across at its narrowest, or northern, extremity, and gradually widening to something over two miles at its southern extremity. As a rule, the ground is less rugged and less irregular than the similar portion of the Rámgarh Forest, and deep ravines run down more or less parallel, eastwards, from the main water-shed line. From the base of the hills the flat ground, occupying less than two-thirds of the whole area, slopes gradually eastwards to the Súswa and is cut up by numerous more or less parallel raus and other water-courses, the principal of which are the Balinda and the two Balindáwála raus, the Amsot, and the Bulláwála, Paniáli and Jhabráwála raus.

Soil and Underlying Rock.—As usual, the soil in the hilly portions is strongly clayey and often ferruginous. On the flat ground below, the soil becomes much richer and the proportion of sand increases, but it is always a strongly clayey loam, being most so in the southern portion. On this flat ground, the portion below Thelwall's line excepted, the soil is generally deep enough to produce a good forest of sál, and, in all the rougher ground, also of sain. In the upper part of the Amsot, water remains at the surface in one place during a considerable part of the dry season, and in all the flat ground and lower hilly portion the permanent level of abundant moisture for the growth of trees is probably generally less than 20 feet below the surface. Except on the very dry upper slopes the growth of grass is tall and dense.

Stock and Area.—The aggregate areas covered by the various types of forest growth are approximately as follows :—

	Acres.
A.—Sál more or less pure	7,336
B.—Sál mixed with sain	2,580
C.—Mixed sál without sain, but with inferior timber trees ...	956
L.—Mixed bamboos	130
M.—Miscellaneous timber trees	389
N.—Scrub	1,620
P.—Grassy blanks	961
Q.—Unproductive	993
Total ...	14,965

The quantity of standing stock is estimated as under :—

Species.	CLASS V		CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above								
	3"		6"	12"	18"		24"		
	and up to								
	6"		12"	18"	24"				
					Sound.	Unsound.	Sound.	Unsound.	
Sál	1,788,480		438,082	113,070	8,092	2,282	718	1,035	2,351,759
Sain	4,511		14,311	11,226	3,445	76	1,046	8	34,623
Sissu	7		19	6	6	...	...	...	38
Chir	345		1,688	1,589	390	...	124	...	4,136
Inferior timber trees ...	609,520		246,317	38,201	7,306	1,484	3,855	2,393	909,076
Inferior trees	220,771		58,969	7,160	2,756	...	...	...	289,656
Bamboo clumps ...	4,888		...	...	...	...	...	...	4,888
Total .	2,628,522		759,386	171,252	21,995	3,842	5,743	3,436	3,594,176

About half-a-mile of the highest portion forms a belt of open inferior scrub containing stunted and crooked sál scattered about, and a few generally small chir on the ridges. At its north-western extremity that belt extends, for more than half a mile lower down, over the inferior soil there. Below this upper belt comes another of mixed sál, which is extremely narrow at the northern extremity but widens out southwards till it attains a development of about a mile and a half across. In the southern half of this belt the proportion of sain is very appreciable. From the edge of the second belt right down to the lower boundary of the forest, there is more or less pure sál, except on the shallow soil near the Súswa, where inferior species form the great bulk of the stock, and where very large areas of grassy blanks or of very inferior open scrub occur. Numerous large patches of grass are also met with near or along the boundary line opposite the Markham Grant. Owing to Mr. Greig's fellings from 1876 to the beginning of 1879, the northern portion of the forest between Thelwall's and Colvin's lines (compartments 13, 15, 17, 19, 21, 23) consists chiefly of saplings and small poles on the stool, up to about nine years old, with about 21 sál standards under five feet in girth to the acre. Between Colvin's line and the Hátiwála road at the northern extremity (compartments 20 and 22), as a consequence of the girdling operations suggested by Dr. Brandis, the number of old and unsound trees is smaller than usual. In the southern half between Thelwall's and the Hátiwála lines (compartments 1, 12) all the young stock or understage is growing up vigorously and straight, being the result of the former damaged and unsound individuals having been cut back. As a rule, the vegetation of sál is very promising, and the condition of the forest is decidedly much above the average. Climbers are not numerous owing to their having been cleared over the greater portion of the flat ground.

Recent History.—The whole of the area between Thelwall's and the Hátiwála lines was divided in 1872-75 by straight and parallel lines running half a mile apart into 24 compartments of about half a square mile each. The numbers of the compartments run from south northwards, the odd and even numbers being respectively below and above Colvin's line.

Fire protection was commenced in 1872 and was extended as follows:—

		Acres.		
1872	(Portion of compartment 15) ...	245	cost not known.	No fires.
1873	(" ") ...	306	" 405	Do.
1874	(Compartments 7, 18) ...	3,840	" 752	Do.
1875	(" 1, 24) ...	7,680	" 2,112	Compartments 1, 7, 9, 16 and 18 and part of 13 (=3,210 acres), burnt in April.
1876	"	7,680	" 448	Compartments 1, 3, 5 and 7 (= 1,280 acres), burnt in February.
1877	"	7,680	" 999	No fires.
1878	"	7,680	separate cost not known.	Do.
1879	"	7,680	" "	Do.
1880	"	7,680	" "	Do.
1881	"	7,680	" "	Compartments 2-6 burnt in 1882.
1882	(The entire forest) above Bullá-wála-Rámgarh road ...	14,485	" "	Do.
1883	... ...	14,485	" "	Do.
1884	... ...	14,485	" "	Do.

The heavy expenditure in 1875 is evidently due to the clearing of the compartment lines.

The first felling operations were undertaken by the Department in 1876-77, under Mr. Greig's orders, and continued up to 1877-78, two compartments having been worked over in each year in the following order: 13 and 15, 17 and 19, 21 and 23. The object of the felling seems to have been to leave standing a certain amount of completely isolated, straight, well-grown sál trees with the object of giving them growing room and cutting down all other growth. About 30 trees on an average were thus spared, which have covered themselves with low branches as a necessary consequence of their isolation, and have obviously lost a considerable amount of vertical increment. The stools of the felled trees, which were, however, cut without any regard to the ordinary rules of coppicing, have sent up shoots, that are now closing over the ground, but are not growing as well as they might have done if the stools had been properly cut. The cultural result of the fellings has been not only to injure the vegetation of the standards left, but to throw back the whole forest at least 20 years. The large sál trees felled were sawn into scantlings and sold, while the poles and small trees were collected at depôts on the forest boundary for gradual sale, and the large quantity of smaller and unsound stuff, for which there was then no market, were left to encumber the area. The total expenditure on the three years' operations was Rs. 16,339, and the gross receipts amounted to Rs. 27,630, thus leaving a net result of Rs. 11,291 or only just over Rs. 6 per acre.

The fellings just described were fortunately stopped, and in the following year, 1879-80, girdling operations, as suggested by the Inspector General in his Suggestions of 20th March 1879, were carried out in compartments 20 and 22. All irregularly shaped sál trees, which were large enough to yield marketable timber, were killed by girdling, as also trees of several other species such as sain, bákli, jáman, etc. It was known that the wood of sál trees that have died a natural death, are much sought after, although perforated to a certain extent by the grubs of borers, and it was believed that trees killed by girdling would yield similar timber. The essential point of difference between the two kinds of death, however, escaped notice. A tree that dies a natural death generally dies gradually from the top downwards, and as each part dies, most, if not all, the reserve matter, such as starch, sugar, oil, etc., on which the borer larvæ feed, is carried down by the usual life processes of the tree, to the living organs below. Thus the larvæ find little sustenance, and only a few of those hatched manage to survive, so that the very small number of their galleries detracts no more from the value of the timber than a few holes bored here and there with an auger. On the other hand, where a tree is suddenly killed by girdling, death is due not to the exhaustion of the reserve matter of plant food, but to the exhaustion of water by unchecked transpiration from the leaves, the waste being prevented from being made good from the soil by the discontinuity of the water conducting channel produced by the girdle. The result of this abundance of food is an abundance of beetle grubs, and the more or less complete riddling of the wood, so that it becomes useless as timber. Such was the economic result of the girdling operations, but the precaution to kill only the few mis-shapen marketable trees has had excellent results from a cultural point of view, in that it got rid of the bad trees and gave the advance growth below plenty of light and growing room, without exposing it and the soil to injury under unchecked atmospheric influences. The girdled trees sold for Rs. 20,066, thus yielding about Rs. 30 per acre. The prices realised were, however, abnormally high and the purchaser lost by the transaction

In 1883-84, all damaged, unsound and unpromising young sál in the southern compartments (1-12) were cut back for an improved regrowth, and climbers were cleared, and injurious inferior trees felled or girdled as the case required.

With the exception of the above operations, no green trees have been felled since the forest has come under Departmental control, but dry trees have every year been exported in the shape chiefly of tors, and green bamboos have of course been cut every year.

Grazing is allowed from the beginning of the rains to the end of December or January, but it is very light, except perhaps in the grass area near the Súswa.

Accessibility.—The average distance of the forest from the following markets or export lines is as under:

	Miles.
From Dehra	15
„ the Ganges	13
„ Kánsrau Pass road	6
„ Dehra-Sahárانpúr road	12
„ Hardwár road	5

Donkey loads of fuel go to Dehra from the western third of the forest. Numerous cart tracks traverse the area in every direction, and every point below the Hátiwála road, and many above it, are easily accessible.

Component Blocks.—Balindáwála, Amsot, and Jhabráwála.

THE BALINDÁWÁLA BLOCK.

Situation.—This block is the northern extremity of the Bulláwála Forest. It is separated on the north from the Phándonwála block of Rámgarh, partly by the Kishanpúr road, partly by the Balinda rau; on the south from the Amsot block by the Pachhuwála line and the Balindáwála rau, and from the Markham Grant by a straight cut-line; on the east it adjoins the village of Nágal and the Nágsidh Forest, and on the west the Chikna, Gáj, and Bínj blocks of the Sahárانpúr Division. The Súswa river flows for about 2½ miles just inside its eastern boundary.

Configuration and Aspect.—For about half a mile just below the main water-shed line the slopes are very rugged, steep and irregular. Below this they are more uniform and broader, look mainly east, and continue, for about three quarters of a mile, almost down to the Hátiwála road. From this line downwards the ground is flat and slopes evenly eastwards to the Súswa, and is cut up by several parallel small raus and other water-courses. The highest and lowest points are respectively 2,934 and about 1,650 feet above the sea, the greatest difference of level being thus nearly 1,100 feet. About half a mile below the main water-shed line, where the hilly portion ends, the average elevation is about 2,200 feet.

Soil and Underlying Rock.—As usual the soil is a sandy loam, underlying chiefly sandstones and conglomerates, fragments of which render it stony in the hilly portion. It is deepest and richest between Colvin's line and the Hátiwála road, and can here produce sál of large size and good quality for the Dún, while below the former line it is very shallow and rests on gravel and shingle deposits. The growth of grass is everywhere heavy.

Stock and Area.—The various types are distributed as follows :—

	Acres.	
A.—Sál more or less pure ...	2,612	The whole area below the hills, except what is under N and P.
B.—Mixed sál with sain ...	414	Most of the lower slopes, except a large patch at the northern extremity.
C.—Mixed sál without sain, but with inferior timber trees ...	367	On the middle slopes immediately above B.
L.—Mixed bamboos	42	Patches and strips in the midst of B and C.
M.—Miscellaneous timber trees ...	389	A large patch on the lower slopes in the north.
N.—Scrub	926	Belt of inferior soil along the Rámgarh-Bulláwála road.
P.—Grassy blanks	701	Mainly a large expanse between Thelwall's and the Rámgarh-Bulláwála road, and a continuous belt containing a number of chir along the water-shed line.
Q.—Unproductive	458	Includes bed of the Súswa.
Total ...	5,909	

Sál is found everywhere, but becomes very scattered stunted and crooked in the upper hilly portions, and is rare in the more or less open grass land below

Thelwall's line. Otherwise it is all but pure and its growth is excellent. Between Thelwall's and Colvin's lines the forest consists chiefly of saplings six years old, and small poles with a few tall, middle-sized sál trees interspersed, the result of Mr. Greig's fellings described above (page 61). A few clumps of bamboo here and there are found at the foot of the lower hills and in the ravines and gullies, and scattered chir along the main crests and ridges.

Recent History.—This block contains eight of the old half-square-mile compartments from Nos. 17-24. Nos. 17 and 19 underwent Mr. Greig's so-called thinnings in 1877-78, and again Nos. 21 and 23 in 1878-79, while in compartments 18 and 20 the girdling operations, recommended by the Inspector General in para. 80 of his Suggestions regarding the management of the forests of the School Circle, dated 20th March 1879, were carried out in 1879-80.

Fire-protection was commenced in 1874 in compartments 17 and 18 (640 acres), and was extended in 1875 to the rest of the area between Thelwall's line and the Hátiwála road, and in 1882 across that road to the whole area up to the main water-parting. Only one fire has ever occurred, *viz.*, in April 1875, when compartments 16 and 18 (640 acres) were burnt. Since the felling and girdling operations described higher up dry wood has been exported in the shape of tors by departmental agency, and during 1884-85 the dry standing and fallen wood up to the Hátiwála line was leased to Bháná Mal.

Accessibility.—Besides the parallel lines forming the compartment boundaries, two forest roads, *viz.*, the Balindáwála and Nágal roads, traverse the lower portion of this block, while the Rámgarh-Bulláwála road runs along the bank of the Súswa and the Mádhowála road crosses its eastern extremity. This is the only portion of the Bulláwála Forest near enough to contribute steadily to the fuel supply of Dehra.

THE AMSOT BLOCK.

Situation.—This block comprises the central portion of the Bulláwála Forest, being separated, on the north by the Pachhuwála line and the Balindáwála rau from the Balindáwála block, and on the south by the Jámanwála line and the Bulláwála rau from the Jhabráwála block; while on the east, Thelwall's line separates it from the Markham Grant and the water-shed line of the Siwáliks from the Bínj and Dhaulkhand blocks of the Saháranpúr Division.

Configuration and Aspect.—Very similar to the preceding block, but with a very much larger proportion of hilly ground and no low-lying ground whatever, owing to the area stopping short about a mile above the Súswa. The highest and lowest points are respectively 2,875 and 1,540 feet above the sea, a total difference of level of more than 1,300 feet, but all the flat ground lies below 2,200 feet.

Soil and Underlying Rock.—As in the preceding block without the shallow soil that characterises that block below Thelwall's line. Moreover, water is found up to late in the hot weather in the Amsot, and generally the soil is slightly moister.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure ...	2,161	The greater portion of the area below the hills.
B.—Mixed sál with sain ...	717	A broad belt along the lower slopes.
C.—Mixed sál without sain, but with inferior timber trees ...	589	A belt immediately above the preceding.
L.—Mixed bamboos	46	Patches and strips in ravines in the two preceding belts.
N.—Scrub	221	A narrow belt along the main water-parting.
P.—Grassy blanks	73	Chiefly large patches near the lower boundary line.
Q.—Unproductive	272	
Total ...	4,079	

The proportion of more or less pure sál forest is much larger in this block than in the preceding one, and the stock is considerably denser. Moreover, chiefly above the Hátiwála road, the proportion of sain is also much larger and good bamboo is found along nearly all the ravines.

Recent History.—This block contains eight of the old half-square-mile compartments, *viz.*, from 9 to 16. Mr. Greig's thinnings were carried out in compartments 13 and 15 in 1876-77. In 1883-84, in compartments 2 and 8, injured sál saplings and small poles were cut back, and harmful trees killed by girdling, and all climbers cleared. It was in this block, in a portion of compartment 15, that fire protection was attempted for the first time in the Dún in 1872. For further details regarding fire conservancy, see description of the forest.

Accessibility.—The block is very accessible, at least up to the lower slopes; but some roads not crossing difficult natural features are required.

THE JHABRÁWÁLA BLOCK.

Situation.—This is the most southerly of the three blocks comprising the Bulláwála Forest. It is separated on the north from the Amsot block by the Jámanwála line and the Bulláwála rau; on the east from the Markham Grant by Thelwall's line; on the south from the Bahera block of the Kánsrau forest by the Jhabráwála line and the Kánsrau, and on the west by the water-shed line of the Siwáliks from the Dhaulkhand and Máluwála blocks of the Saháranpúr Division.

Configuration and Aspect.—The hilly zone here is wider than in the two preceding blocks, being two miles across; moreover the spurs and ravines are more regular and the flat ground along the greater portion of the eastern boundary, where it approaches the Súswa, ends in a plateau; otherwise the surface resembles that of the preceding block. The elevation above the sea ranges between 1,400 and 2,947 feet above the sea, a maximum difference of as much as 1,550 feet, but within the hilly portion alone the ground falls about 900 feet.

Soil and Underlying Rock.—The soil is much more strongly clayey here than in the two preceding blocks, but it is still excellent for sál.

Stock and Area.—The various types of forest growth are thus represented:

	Acres	
A.—Sál more or less pure ...	2,563	The greater portion of the area below the hills.
B.—Mixed sál with sain ...	1,449	The hilly portion up to within half a mile from the water-shed line.
L.—Mixed bamboo	42	Patches and strips in the midst of B.
N.—Scrub	473	A broad belt along water-shed line.
P.—Grassy blanks	187	Mainly near lower boundary line.
Q.—Unproductive	263	
Total ...	4,977	

The stock resembles that of the preceding block, except that it is, on the whole, older and, together with the reproduction, is somewhat denser. Besides this, bamboo is slightly less abundant.

Recent History.—The portion below the Hátiwála road comprises the first eight of the old half-square-mile compartments. Fire-protection was commenced in 1874 in compartments 7 and 8 (640 acres). In 1875, it was extended to the first six compartments, and in 1882 to the rest of the area. Nearly the whole protected area (compartments 1-7 = 2,240 acres) were burnt in 1875; compartments 1, 3, 5 and 7 were again burnt in 1876 and 2-6 again in 1882. Thus compartments 3 and 5 have been burnt three times in ten years.

Coppice improvement operations took place, as described under the forest, in 1883-84.

Accessibility.—Carts can go about easily over all the flat ground in the block, while the Dehra-Hardwár road is only a mile and a half from its

lower boundary and the Kánsrau pass road three miles from its southern boundary.

THE NÁGSIDH FOREST.

Situation and Concessions.—This forest occupies the large outlier of the Siwáliks known as the Nágsidh hill, which is situated seven miles from Dehra Dún, between the Súswa on the west, and the Song on the east. On the south and west the area stretches for some distance over the flat ground away from the foot of the hill, and on the east it runs along the bed of the Song for about seven miles from Báláwála to the Banbáha. On the north its boundary, which consists chiefly of streams, marches along those of the private lands of Indarpúr, Nawáda, Haripúr Mohkampúr Kalán and Khurd, Harrawála, Kuáwála and Nakraunda (both Mr. Daly's and Dhúm Singh's) and Báláwála. On the east it adjoins the Lambirau block of Tháno and the private lands of Kálúwála, Sangtiawála Kalán, Baksarwála, Kanharwála, Bhániawála and Mr. Lister's Májri Grant. On the south it rests up against the Nichla Song block of the Kánsrau Forest, and marches with the private lands of the Markham Grant, Ghísarpáni, Daiswála, Misanwála Khurd and Kalán, and Lachhiwála, while on the west it is bounded by the Balindáwála block of Bulláwála, the Ásárori block of Rámgarh and the private lands of Nágal, Balindáwála, Kishanpúr, Dúdhli, Phándonwála, Muhammadpúr, Mothronwála and Kidárpúr. The boundary is thus a very long, tortuous and difficult one to protect.

The undermentioned villages are allowed to remove under free passes head-loads of fallen dry fuel, and to graze cattle at half rates as follows:—

Village.	Buffaloes.	Bullocks and cows.	Ponies and donkeys.	Sheep and goats
Nawáda ...	5	105	...	...
Dúdhli ...	6	125	...	...
Balindáwála and Nágal ...	...	60	...	...
Phandon ...	4	30	...	...
Pandit's Nágal ...	10	75	...	...
Muhammadpúr ...	4	45	...	...
Kishanpúr ...	16	30	...	...
Majri ...	...	140	5	...
Badripúr ...	28	160	...	...
Mokhampúr Khurd ...	5	130	...	...
Mothronwála ...	35	200	5	...
Total	113	1,106	10	

Besides the above concessions, the way from Dúdhli to Madhowála is kept open to the public, and the Markham Grant is allowed to use water from the Song. Inside this forest, about half a mile west of the Dhauláni Rest Hut, is situated the shrine of Lachhman Sidh, where a sádhu is allowed to squat entirely as a matter of favour, and people are permitted to visit it once a year on the day dedicated to it. Only one private forest of any importance adjoins Nágsidh, and that is the Báláwála estate of the Rája of Náhan. The Lister Grant at Májri contains a scrub of khair and other inferior species, but all the wood in it either belongs to Government and is at the disposal of the Forest Department, or has been bought by Mr. Lister. The Markham Grant also contains a little sál and some scrub.

Configuration and Aspect.—The Nágsidh hill runs nearly east and west across the greater portion of the area outside the bed of the Song, but on the south it throws out long spurs reaching, or almost reaching, the Súswa. About one-sixth of that portion of the block, consisting chiefly of the northern face of the hill and the flat ground near Mohkampúr, is drained eastwards by the Dhauláni Naddi and its main tributary, the Dándi Khála, into the Song; while easy northern slopes just above Nawáda are drained directly into the Rispana, and all the rest of the area west of the Dehra-Hardwár road (which, although it runs within a few hundred yards of the Song and its feeder, the Re Naddi, follows the watershed line between the Song and Súswa) is drained southwards into the Súswa. This last drainage area consists of the southern face of the hill with its long, sharp, parallel spurs and deep included valleys, and of all the large extent of flat ground to the south and east. East of, and along, the Dehra-Hardwár road, for about three miles, the ground consists of a narrow plateau with steep, irregular

sides descending into the valley of the Re Naddi and of the Song. The remainder of the forest lies chiefly within the broad bed of the Song, and comprises numerous low, flat islands. The highest point is on the main ridge of the Nágsidh hill, 2,635 feet above the sea, while the lowest is at the extreme southern extremity about 1,450 feet above the sea. The Nágsidh hill rises only about 500 feet above the plain on the north, and about 700 feet above that on the south.

Soil and Geological Formation.—Everywhere outside the bed of the Song the soil is a rather stiff loam, which becomes strongly clayey in many places, as along the Hardwár road, opposite Náwada, etc., and it is usually deep, except, of course, along the crests and steeper slopes of the Nágsidh Hill, which is composed chiefly of sandstone, and in the flat ground in the vicinity of the Súswa river, where the underlying deposit of shingle and boulders is close to the surface. Omitting this latter portion, which is generally unfavourable for a good forest growth, and the patches where clay is in excess and favours sain, the soil is extremely well adapted for sál.

Inside the bed of the Song, including all the flat, low land east of the Hardwár road, the soil is alluvial and suited only for khair and inferior species, and in the better drained places also for sissu. There is flowing water in the Re Naddi and in the main channel of the Song throughout the year. Limestone pebbles washed down from the Himalayas, and excellent for the manufacture of lime, are abundant in the Song.

Stock and Area.—The area is stocked as follows :—

	Acres.
A.—Sál more or less pure	3,126
B.—Mixed sál with sain	3,157
C.—Mixed sál without sain, but with inferior timber trees ...	5,322
F.—Sissu	10
G.—Khair	382
H.—Mixed sissu and khair	513
M.—Miscellaneous timber trees	1,724
N.—Scrub	727
P.—Grassy blanks	793
Q.—Unproductive	763
Total ...	16,517

The subjoined statement contains an estimate of the quantity of stock :—

Species.	CLASS. V	IV	III	II		I		Totals.
	Diameter above							
	3"	6"	12"	18"		24"		
	and up to							
	6"	12"	18"	24"				
				Sound.	Unsound.	Sound.	Unsound.	
Sál	476,448	357,119	78,126	11,697	2,198	1,235	1,145	927,968
Sain	44,013	21,992	4,778	1,880	122	489	15	73,289
Sissu	5,937	10,181	1,369	170	...	23	...	17,680
Chir	1,672	509	...	...	...	...	...	2,181
Khair	68,744	66,527	1,320	7	...	...	...	136,598
Inferior timber trees ...	297,573	281,102	26,699	5,778	950	4,337	1,656	618,095
Inferior trees	278,657	130,297	7,088	386	...	...	...	416,428
Bamboos	74	...	...	...	...	...	...	74
Totals ...	1,173,118	867,727	119,380	19,918	3,270	6,084	2,816	2,192,313

The sharper ridges and crests of the Nágsidh Hill bear a more or less open forest of inferior species, which also extend over the patches of the more clayey or otherwise unfavourable soils. Excluding the above, and the several large areas of old cultivation, now open grass land, the entire hill and all the surrounding flat ground above the immediate influence of the Song and Súswa and the Re Naddi are stocked with an excellent pole forest, consisting principally of sál with a varying sprinkling, often very marked, of sain. But there is one remarkable exception to this rule; on the high ground west of Misanwála Kalán the stock resembles the type prevailing in the low-lying land near rivers, which contains sissu and khair with the usual admixture of Albizzias, Odina, etc. The sissu trees are all old, and prove beyond doubt the former low position of this area with regard to surrounding land. The area through which the Re Naddi meanders, bears a scrub, often very dense, of swamp-loving species such as *Mallotus, Trewia, Tetranthera, Albizzia*, &c. As along the Súswa and practically included in its bed, so in the long strip lying in the bed of the Song, the forest growth consists chiefly of khair mixed with some sissu, and in other places the ordinary species of such terrain.

With the exception of some of the flat ground along the northern boundary of the forest, the reproduction of sál in forest of that species is nearly all that can be desired, and sain is in many places quite as good as sál, and, in any case, is more abundant and more widely distributed than it is in the upper crop. In the beds of the rivers, young sissu is not well represented. Damage done by climbers is chiefly limited to southern and western slopes of the Nágsidh Hill.

Recent History.—Fire protection was commenced in 1884, but was limited to the area included between the Hardwár, Lachiwála-Bulláwála, and Mádhowála roads and a cross road through the Mádhowála tappar joining the two last. This area was also closed against grazing in the usual manner with the consent of the Collector. Fire conservancy has now been extended over all the remaining area, but without being accompanied by the exclusion of cattle.

Dry wood and grass have always been exported from this forest, and the felling of green trees has been confined by the Department only to some sál timber required for Government buildings, and to the sale of khair for sugar-mill crushers. But the forest has suffered wholesale damage at the hands of fraudulent lessees who, having purchased the right to remove dry timber, killed, during two successive years, 1883-84, thousands of growing sál by girdling and hacking them.

Large herds of buffaloes and cows are grazed in this forest in the northern portion and along the Súswa, owing to the rich pastures and abundance of water there, and to the proximity of Dehra, which receives nearly half its milk supply from the villages and grazier settlements along the northern boundary. The grazing is so heavy that the grass is cropped off down to the roots, and the soil is trodden so hard, that not only is the production of new seedlings in these parts extremely difficult, but the vegetation of the existing forest growth is very seriously affected, and sál trees are rapidly dying out on the strong clay soils.

All the extensive, flat, open ground near the Súswa, immediately north of the Markham Grant, is the site of the former cultivation and village of Mádhowála, which, it is related, was abandoned on account of the destruction of its cattle by tigers, and also in obedience to an omen, manifested by the death of one of the inhabitants by a tiger. Several other areas inside the forest were also under cultivation round Mádhowála and near Kishanpúr and Harráwála.

Accessibility.—This is perhaps the most accessible forest in the Dún, being connected with Dehra, eight miles off, by a bridged road, which, after traversing it, goes on to Hardwár. The average distance from the Ganges is 16 miles. Carts can circulate freely every where except on the spurs and ridges of the Nágsidh hill, which, however, offers no difficulty whatsoever for pack animals.

Component Blocks.—The portion in the Song forms one block by itself, the so-called Uparla Song block, while the rest of the area is divided into the three blocks, the descriptions of which immediately follow, *viz.*, Dúdhli, Nawáda, and Lachhiwála.

THE DÚDHLI BLOCK.

Situation and Concessions.—This block comprises the whole of the southern face of the Nágsidh Hill, together with the large triangular raviny ground forming more than half of the total area immediately below it. On the north, on the opposite face of the hill, lies the Nawáda block; on the east, separated from it partly by the Dhai khála, partly by the Madhowála road, the Lachhiwála block, and on the south and west, separated from it by an arm of the Súswa, the Balindáwála block of Bulláwála and, with principally cut lines between, the private lands of Nágal, Balindáwála, Kishanpúr, Dúdhli, Phándonwála, and Muhammadpúr, and the Asárori block of Rámgarh. All but the last of the above-mentioned villages enjoy the concessions referred to in the description of the forest, and the extent to which they can graze cattle at half rates is as follows:—

Village.	Buffaloes.	Bullocks and cows.	Ponies and donkeys.
Dúdhli ...	6	125	...
Balindáwála, Nágal	0	60	...
Phándu ...	4	30	...
Pandit's Nágal	10	75	...
Muhammadpúr	4	45	...
Kishanpúr	0	36	...
Total ...	24	371	...

The remaining villages shown in the list on page 35 are situated much nearer other portions of the forest to care to use this block.

Configuration and Aspect.—The general fall of the ground is to the south, but in the hilly portion the peculiar configuration, already described under the forest, produces a succession of easterly and westerly aspects.

Soil and Underlying Rock.—On the higher ridges and spurs, and on the steeper slopes the soil is stony, but the underlying rock is generally a loose conglomerate which is practically a true soil in itself. Elsewhere the soil is a sandy loam, becoming sometimes strongly clayey, and is generally of good quality and great depth, and is capable of producing sál and sain of average dimensions. The growth of grass is tall and heavy wherever the ground is open.

Stock and Area.—The various types of growth are thus distributed:—

	Acres.	
A.—Sál more or less pure ...	1,091	Principally the flat ground immediately north of Dúdhli, Kishanpúr, and Nágal.
B.—Mixed sál with sain ...	946	Mainly the flat but broken raviny ground west of the Mádhowála road.
C.—Mixed sál with sain, but with inferior timber trees ...	2,741	All the hilly portion, except the crests of the spurs and ridges.
G.—Khair	204	The lowlying ground immediately along the Súswa.
M.—Miscellaneous timber trees ...	453	The crests of the spurs and ridges, and some patches of inferior soil west of Dúdhli.
N.—Scrub	260	Chiefly the low-lying ground away from the Súswa.
P.—Grassy blanks	98	Large patches near Nágal.
Q.—Unproductive	134	
Total ...	5,927	

With the exception of the south-western extremity, near the Súswa, which consists of one large patch of khair and another of mixed inferior species, sál is met with everywhere, but only as scattered and not very vigorous individuals along the crests of the main ridge and spurs, and in the patches here and there of

very dry soil. Generally speaking, the forest is fairly dense and the vegetation of sál up to the average. Sain is very abundant and of excellent growth on the deep, clayey soil on the level ground between the Súswa and the hilly portion. Over the greater portion of this ground the reproduction of both sál and sain is very promising. Elsewhere it is extremely backward owing to the unfavourable soil and configuration, and to grazing and fires. Several large, grassy blanks occur, especially in the southern portion near Kishanpúr and Nágal. A few bamboo clumps are found in three or four places, but producing only small shoots. Climbers, especially máljhan, are, in places, very abundant and destructive.

Recent History.—Under the lease system sál has been very heavily felled here by fraud.

This block has been under fire conservancy only since 1886-87, but even previous to that date the whole area was never burnt in any year, thanks to the configuration of the ground and the nature of the growth.

Owing to the proximity of the Súswa and the water in it, large numbers of cattle coming from Dehra and other places graze in this block with the local herds.

Accessibility.—The average distance from Dehra is about eight miles. Carts can go over the greater portion of the area with ease, and pack animals, and of course men, everywhere.

THE NAWÁDA BLOCK.

Situation and Concessions.—The Nawáda block is situated at an average distance of seven and half miles from Dehra, chiefly on the northern face of the Nágsidh Hill. On the north, west and east its boundaries march with those of the Ásárori block of Rámgarh, and of the village lands of Mothronwála, Kidárpúr, Indarpúr, Nawáda, Haripúr, Mokhampúr Kalán and Khurd, Harráwála and Kuáwála. Of these villages only Nawáda, Mokhampúr Khurd and Mothronwála avail themselves of the usual concessions, besides two others away from the boundary, *viz.*, Májri and Badripúr. The number of cattle they may graze at half rates is as follows:—

Villages.	Buffaloes.	Cows and bullocks.	Ponies and donkeys.	Sheep and goats.
Nawáda ...	5	105	...	...
Mohkampúr Khurd ...	5	130	...	...
Mothronwála ...	35	200	5	...
Májri ...	16	140	5	...
Badripúr ...	28	160	...	...
Total ...	89	735	10	...

The remaining villages on the list of concessionaries being situated too far away, have no inducement to send their cattle into this block.

Configuration and Aspect.—With the exception of the level ground along the northern and eastern boundary, which forms about one-third of the whole area, the rest of the ground is hilly, but the western half of the hilly portion consists chiefly of plateaux. The western portion of the block is drained north-westwards into the Rispana, and the rest of the area eastwards into the Dholáni Naddi, a tributary of the Song. Thus the ground falls in two almost opposite directions, while the numerous spurs running towards various points of the horizon produce every variety of local aspects. The highest and lowest points are respectively 2,635 and about 2,000 feet above the sea, but most of the ground lies between 2,500 and 2,200 feet.

Soil and underlying Rock.—The soil resembles that in the preceding block, being dry and stony, and in some places clayey and very hard along the main ridge and some of the spurs, and also near the boundary line west of Dholáni.

Stock and Area.—The area is stocked as follows :—

	Acres.	
A.—Sál more or less pure	530	Mainly the flat ground near the northern boundary.
B.—Mixed sál with sain	480	Chiefly the basin of the Rámgarh sot and Dháorwáli rau in the south-west corner.
C—Mixed sál without sain, but with inferior timber trees ...	2,191	The rest of the area, excluding the crests of the main ridges, and patches of very broken ground along the raviny water-courses.
M.—Miscellaneous timber trees ...	296	Principally the crest of the main ridge and the greater portion of the broken ground just referred to.
N.—Scrub	91	Small patches on the broken ground.
P.—Grassy blanks	90	Mostly old cultivation sites west of Dholáni.
Q.—Unproductive	91	
Total ...	3,769	

The stock here is more purely sál than in the preceding block, and is also of better quality. It consists chiefly of poles, but larger trees become more numerous towards the hilly portion. In the western half there are some old cultivation sites which have now become grazing grounds, and in which the soil has been trodden so hard by cattle that there is scarcely a trace of reproduction. In the western portion, where grazing has not been heavy for long, there is plenty of advance growth on the ground, which cannot, however, make its way up because of the dense leaf-canopy and of the hardening tread of cattle. In spite of this the pole growth of sál is excellent.

Recent History.—This block was for the first time placed under fire conservancy in 1884-85, but in previous years, owing to the absence of grass, due to the heavy grazing and tree-cover, fires, although annual nearly everywhere, were never very severe in themselves, although they were very fatal coming on the top of other circumstances extremely unfavourable for forest vegetation.

The grazing in this forest is much heavier than in the Dúdhli block, the grass in most of the western portion being almost shaven off the ground. The western hilly portion has suffered very considerably by the operations of fraudulent lessees.

Accessibility.—This block is by far the most accessible portion of the Nágsidh Forest, being flanked by the Dehra-Hardwár road and tapped by cart tracks from the numerous adjoining villages.

THE LACHHIWÁLA BLOCK.

Situation and Concessions.—This block lies between the two preceding on the west and the Uparla Song block on the east, at an average distance of 10 miles from Dehra and 20 miles from the Ganges. The private lands of Kûawála and the two Nakraundas adjoin it on the north, and of Lachhiwála, Misarwála Kalán, and the Markham Grant on the south.

None of the concession-holding villages are situated near enough to use this block.

Configuration and Aspect.—With the exception of the north-western corner, which includes the eastern extremity of the Nágsidh Hill, the whole area is quite flat, but cut up by numerous deep ravines. The Hardwár road, running close to its northern boundary, forms the water-parting between the Song and Súswa, so that by far the greater portion of the area is drained southwards into the latter stream. The ground in the basin of the Song consists of a narrow plateau flanking the Hardwár road, along the foot of which the Re Naddi flows. On the other side of this Naddi the drainage is, in many places, greatly impeded, and swamps are formed in consequence, which have, however, been successfully drained since 1884 by the Public Works Department. The whole of the area lies approximately between 2,500 and 1,600 feet above the level of the sea.

Soil and Underlying Rock.—The soil is generally a sandy loam, but strongly clayey in many places, as along the Hardwár road. It is of great depth nearly everywhere, and rests on a deposit of shingle and boulders. Sál and sain can acquire at least their average dimensions here. The growth of grass is heavier than in either Dúdhli or Nawáda.

Stock and Area.—The area is under the following types:—

	Acres.	
A.—Sál more or less pure	1,505	Mainly the flat expanse of ground between the Lachhiwála and the Mádhowála Tappars, exclusive of a belt about a quarter of a mile wide along the boundary line.
B.—Mixed sál with sain	1,731	Nearly all the flat, but broken ground formed by the upper course of the nalas coming down from the Hardwár road, with the plateau on the north and east of that road.
C.—Mixed sál without sain, but with inferior timber trees.	390	Chiefly the east face of the Nágsidh Hill.
M.—Miscellaneous timber trees ...	432	Principally two long belts; one along the lower course of the Re Naddi, the other along the Markham Grant.
N.—Scrub	376	Also two main patches, one west of Lachhiwála, the other, much the larger of the two, occupying the lowlying ground along the upper course of the Re Naddi.
P.—Grassy blanks	475	One extensive area near the Súswa (the Madhowála Tappar) and four or five others between that and Lachiwála, in the midst of well-grown forest.
Q.—Unproductive.	187	
Total ...	5,096	

On the swampy or low-lying ground east of the Hardwár road sál is totally absent, and the stock, generally very dense, consists of inferior species, canes being abundant along the northern boundary. This sál-less belt crosses the road at Lachhiwála, but improves there owing to the more favourable soil and situation, and near Lachhiwála sál penetrates it here and there, while along the boundary of the Markham Grant, khair and sissu form a large proportion of the crop. Again, at the south-western extremity near the Súswa, the ground in the rains becomes too damp for sál, but scattered clumps of sissu exist in company with a great deal of grass, and some simal, dhák, &c. Everywhere else, barring certain very large blanks, resulting from old cultivation, but which can be easily converted into sál forest, we meet with more or less pure sál containing a strong sprinkling of sain in many places. This class of forest is generally below middle age, and is coming on splendidly, if we omit the strip on each side of the Hardwár road, where, besides the soil being clayey, grazing is very heavy. But even under these circumstances the soil is capable of producing an excellent forest of sain. Wherever there is sál forest the reproduction of that species is magnificent, and is spreading slowly but steadily over the large blanks, in which the chief obstacle it has to overcome is frost.

Recent History.—All the large grassy blanks in the southern portion of the block were the sites of the out-lying cultivation of the deserted village of Mádhowála. The area included between the Hardwár, Halgoa, Mádhowála and Lachhiwála-Bulláwála roads and the cross-road through the Mádhowála Tappar

has been closed and protected from fire since the spring of 1884, and dating from the following year the rest of the block, although not closed, has also been brought under fire-protection.

Grazing is very heavy in the Mádhowála Tappar, and along the Re Naddí; and until the area was closed, it was so also across the Hardwár road right up to the Nágsidh Hill.

Small experimental sowings and plantations of sál, sissu, bamboo, and a few other species, have been made during the last four rainy seasons at Jabarkhet, but have failed from absence of protection against frost, the grass round the seedlings having been cut away. Two small temporary nurseries exist, one at Lachhiwála, the other at Jabarkhet.

Accessibility.—Although less accessible, from being further away from Dehra, than the Nawáda block, it is the most accessible portion of the Nágsidh forest as far as the passage to and fro of carts is concerned. The Mádhowála-Halgoa, Lachhiwála-Bulláwála and Jabarkhet roads form an almost complete net-work of export lines traversing it in every direction, and the Hardwár road, completely bridged, runs through its eastern length on one side.

The Upárla Song Block.

Situation and Concessions.—This block is a sort of appendage to the Nágsidh Forest, and comprises all the long, narrow strip of Government land in the bed of the Song, from Báláwála in the north to the southern extremity of the Markham Grant in the south, a distance of about eight miles. The following private lands border it:—On the north Báláwála, belonging to the Rája of Náhan; on the east Kaláwála, Sangtiawála Kalán, Baksarwála, Kanharwála, Bhániáwála and Mr. Lister's Grant; on the west the Markham Grant, Ghísarpuri, Daiswála, Misarwála Khurd, Misarwála Kalán and Dhumsing's Nakraunda. It is conterminous, for about three miles on the west, with the Lachhiwála block; for about three-quarters of a mile on the east with the Lambirau block of the Tháno Forest; and on the south, for about half a mile, with the Nichla Song block of the Kánsrau forest.

This is the only portion of Nágsidh not burdened with any grazing or wood concessions.

Configuration and Aspect.—As has already been said, the whole block lies in the bed of the Song, and hence consists of low-lying lands, partly flooded in the rains, and of the various channels of the river.

Soil and Underlying Rock.—The soil is mostly alluvial, and is thus composed of silt; it is seldom very deep, and overlies shingles and boulders. It is naturally totally unsuited for sál, but is essentially fit for khair with sissu, except in the north-western portion, where it is not sufficiently drained for the latter species.

Stock and Area.—The area is stocked as follows:—

		Acres.	
F.—Sissu more or less pure	...	10	In one patch in the northern portion in the main channel of the Song.
G.—Khair more or less pure	...	178	In several patches everywhere.
H.—Mixed sissu and khair	...	513	In continuous strips or more or less large patches along the whole length of the block.
M.—Miscellaneous timber trees	...	543	Chiefly in one large patch extending from Lachhiwála right up to the northern boundary, and occupying the badly drained soil with a smaller patch opposite Jiwangarh.
P.—Grassy blanks	...	130	More or less large patches everywhere.
Q.—Unproductive	...	351	Chiefly the boulder beds of the various channels of the Song.
		1,725	

As a rule, the whole stock is of a very inferior description, being young and patchy, and generally consisting of dwarfed, crooked, and languishing trees.

Recent History.—This block has never been protected from fire, and the whole of its northern portion is very heavily grazed over. The only fellings of green trees that have been made have been those for sugar-mill crushers up to five years ago, and for fuel for lime-burning since then.

Accessibility.—Carts can pass over every portion of the area, and the average distance of the Dehra-Hardwár road is less than a mile.

THE KÁNSRAU FOREST.

Situation and Concessions.—The next six blocks comprise the Kánsrau Forest, which extends from the Bulláwála Forest, the Markham Grant, and the Uparla Song block of the Nágsidh Forest, on the north, to the Motichúr Forest and the private lands of Partítnagar, on the south. On the east it adjoins Mr. Lister's Májri Grant, a block of Government waste land over which Mr. Lister possesses the right of pre-emption up to 1888, Jógíwála, Sáhibnagar, the Ghamandpúr block of the Tírsál Forest, Khairi Kalán and Khurd, Thákurpúr, Kharak, and Gohri; on the west the water-parting of the Siwáliks separates it from the Betban block of the Saháranpúr Division. Its most easterly point is less than half a mile from the Ganges and about eight miles from Hardwár. Its north-eastern boundary takes in the whole of the course of the Song and Súswa from the Banbáha and Jhabráwála to Gohri, a distance of about nine miles.

There is a little open scrub of badly grown khair, and inferior species in the adjoining portion of the Markham Grant, and the Government waste land contains a more or less dense stock, composed chiefly of khair. Moreover, a limited extent of jungle of inferior trees exists in Jogiwála and Sáhibnagar, and some sál with bamboos in Partítnagar.

There are no private rights or concessions of any kind in this forest.

Configuration and Aspect.—A little less than half the area is hilly, and an equal portion comprises the channels, islands, and immediate banks of the Song and Súswa rivers, while the remainder occupies the middle flat ground in the north between the first two areas. About half the hilly ground lies inside the true Siwáliks, the other stretching along the northern face of the small isolated hill (Jámankháta) between the Súswa and the Motichúr rau. The Siwáliks here consist of an alternation of long parallel spurs and the included ravines, all trending out eastwards. The sides of the ravines are often steep, but the crests of the spurs nearly all ascend by easy gradients to the main ridge of the Siwáliks. The Jámankháta hill rises up at once from 500 to 700 feet above the plain, and its sides consist of short spurs separated by generally shallow ravines. The flat ground below the Siwáliks partakes of the nature of a plateau intersected by numerous dry water-courses. All the portion mentioned above as stretching along the rivers is necessarily low-lying, and is nine miles long by three quarters of a mile broad on an average, being broadest at its upper extremity.

The highest and lowest points of the forest are respectively about 2,800 and 1,050 feet above the sea, and the average fall of the river portion is about 50 feet in a mile.

Soil and Geological Formation.—The soil is necessarily very variable, from free, fine sand to stiff clay. Above the Paniáli rau and the Jhabráwála-Kánsrau road it resembles very much the soil in the preceding forest, except that in the hilly portion it is slightly deeper and of a better quality. On the slopes of the Jámankháta hill, which is composed principally of conglomerates, the soil is a sandy loam, rather stony, but well adapted for sál, as the clay bed is not very far from the surface and produces perennial springs at the foot of, and even inside, the hill, as for instance in the Panoti rau.

The whole of the river portion of the forest, including both banks up to half a mile, consists of silt showing various degrees of consolidation; it is very rich in many places, and is always strongly calcareous. Here there is abundance of water close to the surface, and the band of clay not being far off, and the fall of the ground insufficient, large tracts remain water-logged throughout the

whole or greater part of the year. The Song and Súswa, and all the channels of the other streams which go to compose the complicated maze of islands and water-courses, run all the year round. There are only two small patches in this area high enough to be well drained to suit sál which, however, grows excellently well there, thanks to the abundance of moisture.

The growth of grass is everywhere heavy where the tree vegetation is open, and is extraordinarily tall in the large flats in the river portion.

Stock and Area.—The various types of forest growth are represented as follows :—

	Acres.
A.—Sál more or less pure	3,209
B.—Mixed sál with sain	2,020
C.—Mixed sál without sain, but with inferior timber trees ...	3,964
F.—Sissu	515
G.—Khair	1,033
H.—Mixed sissu and khair	1,209
I.—Mixed chir	68
L.—Mixed bamboo	721
M.—Miscellaneous timber trees	2,420
N.—Scrub	2,359
P.—Grassy blanks	1,034
Q.—Unproductive	2,388
Total ...	20,940

The quantity of stock is estimated as follows :—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Totals.
	Diameter above 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound.	Sound	Unsound.	
Sál	581,697	464,547	41,826	6,366	587	1,272	975	1,097,270
Sain	15,001	38,730	7,821	1,480	2	370	347	63,751
Sissu	15,661	31,208	7,163	505	46	54	18	54,655
Chir	443	1,401	940	119	...	...	...	2,903
Khair	101,869	73,105	2,798	342	...	...	...	178,114
Inferior timber trees ...	357,379	379,593	54,238	12,833	2,023	6,042	2,616	814,724
Inferior trees ...	179,225	90,852	4,550	157	...	...	...	274,784
Bamboo clumps ...	21,141	...	...	...	...	...	...	21,141
Totals ...	1,272,416	1,079,436	119,336	21,802	2,658	7,738	3,956	2,507,342

The stock in the Siwálik portion and the lower ground below, as far as the Jhabráwála-Kánsrau road, resembles that in the adjoining Jhabráwála block of the Bulláwála Forest, but is, perhaps, on the whole, slightly denser. In the

Jámankháta hill portion the stock consists principally of sál with jáman, Bauhinias, bákli, &c., the last named species increasing in number with the altitude; and the eastern portion of the main crest is crowned with mixed bamboo forest, the commencement of the belt which extends right down to Kharkhari. The low water-logged flats bear either tall, reedy grass, or forest of the evergreen type found in the Dún. *Mallotus* is the most abundant species, and tun is fairly numerous for a natural forest. All other places in the river portion are stocked with sissu and khair, pure or mixed, in the latter case associated with their usual companions. The reproduction of sissu is making steady but slow progress. Considering every circumstance the Kánsrau Forest is one of the most valuable in the Dún.

Recent History.—Owing to the unhealthy climate, grazing, although only a comparatively small area is closed, is very slight, and is chiefly limited to the edge of the river portion from Jogiwála downwards. In 1879, on the recommendation of the Inspector General, and in view of the great demand that then existed for sugar-mill crushers of khair, the river tract east of the Hardwár road and above Dáluwála, measuring 1,600 acres, was closed against grazing and protected from fire, these arrangements having continued up to date. Since 1882, the whole of the Bahera block above the Jhabráwála-Kánsrau road has been closed and placed under fire conservancy, which in 1886 was extended also to the Jámankháta and Partítnagar blocks.

Under the Forest Department, the only sales of green trees have been as follow:—

In 1883-84	400 sissu above 5′ girth.
"	200 jáman and harra above 5′ girth.
" 1884-85	Jáman above 5′ girth.
" 1885-86 and 1886-87	Inferior timber trees for canal works.

Besides a few large sál for departmental purposes at Dehra, bamboos have been cut every year without any period of rest. All dead wood for which there was any demand has been regularly exported in the shape of karis, tors, ballis, and firewood.

Accessibility.—With the exception of the Siwálik portion, all the remainder of the area is situated conveniently enough for export of firewood *viâ* the Ganges. Sál karis and tors go out at present entirely over the Siwáliks by the Kánsrau Pass to the nearest Ganges Canal station, and are half dragged, half carried by buffaloes and bullocks.

Component Blocks.—Nichla Song, Bahera, Jámankháta, Uparla Súswa, Nichla Súswa and Partítnagar.

The Nichla Song Block.

Situation.—This block occupies the bed of the Song and Súswa from the Markham Grant and the southern extremity of the Uparla Song block to the Kánsrau-Dáluwála road (near which the two rivers unite, and which separates it from the Uparla Súswa block), together with the land lying between those two rivers and through which the extraordinary connecting channel, the Banbáha, flows. On the east lies Mr. Lister's Grant and the block of Government waste land, while on the west the main stream of the Súswa separates it from the Jhabráwála Block of the Bulláwála forest, and from the Bahera and Jámankháta blocks.

Configuration and Aspect.—The Súswa, Banbáha and Song, as usual, split up into numerous channels enclosing flat, low-lying islands, while the land included between these streams is equally flat and low. The bed of the Song is much higher than the immediately opposite points of the Súswa, and hence the Song, being a larger stream, and receiving its waters from an extensive drainage area stretching right away behind the first range of the Himalayas, has a tendency to make a short cut to the Súswa, especially when it is in flood, the result being the formation of the Banbáha before alluded to and the gradual abandonment by the Song of its main bed below the point where the Banbáha leaves it. If denudation of the forest growth along the sources of the Song is allowed to go

beyond a certain point, it is certain that that river will spread over and cut up all the flat land between it and the Banbáha, and form there with the Súswa a huge maze of dry shingle and boulder-strewn channels and low shifting islands more than a mile broad.

The highest and lowest points are respectively about 1,500 and 1,300 feet above the level of the sea, being a total fall of approximately 200 feet in nine miles or an average of nearly 60 feet per mile.

Soil and Underlying Rock.—The soil is all alluvial and is generally very shallow, resting on a deposit of shingle and boulders; and the open, flat land between the streams is in many places water-logged. It is evident that sál cannot be grown anywhere in this block which is most suitable for khair generally, and for sissu in the better drained islands in the main channel of the Song.

Stock and Area.—The area is stocked as follows :—

		Acres.	
F.—Sissu more or less pure	...	71	Chiefly limited to the islands in the Song.
G.—Khair more or less pure	...	823	Extends along both sides of the Banbáha on the higher ground between the Song and the Hardwár road, crossing that road in one place; also in similar ground on the left bank of that river.
H.—Mixed sissu and khair	...	604	Confined to the islands of the Song.
N.—Scrub	...	1,342	Everywhere else where the ground is not unproductive or swampy.
P.—Grassy blanks	...	328	Comprises chiefly the very low wet ground between the Banbáha and the Súswa.
Q.—Unproductive	...	722	
Total	...	3,890	

The predominant species is khair and the present stock is generally very open, dwarfed, and badly grown. Sissu is reproducing itself extremely well in the patches of new silt deposits in the Song.

Recent History.—The area east of the Hardwár road has been closed and protected from fire since 1879, with the object of obtaining a complete new crop chiefly of sissu and khair, by means of natural reproduction.

No green trees have been felled since the advent of the Department. Lime burning is extensively carried on in this block.

Accessibility.—Every portion of the block is accessible to carts. Its average distance from the Ganges is about nine miles, and from Máiápúr about 16 miles.

THE BAHERA BLOCK.

Situation.—This block includes all the true Siwálik portion of the Kánsrau Forest, together with the flat land lying below and extending to the Súswa opposite the Nichla Song block. On the north it is separated from the Jhabráwála block of Bulláwála, partly by the Jhabráwála line, partly by one of the Káns raus; on the south from the Jámankháta block, by one of the Káns raus, and from the Dánda and Koelpúra blocks of the Motichúr Forest by a long spur which runs parallel to the upper course of that rau; and on the west from the Betban block of the Saháranpúr Division by the water-shed line of the Siwáliks.

Configuration and Aspect.—More than half the block lies inside the Siwáliks, which here throw out long parallel spurs eastwards from the main ridge; thus, though the main fall of the ground is eastwards, the local aspect is chiefly north and south alternately. The slopes are generally steep, but the main crest of the long spurs rises up in easy gradients suitable in most cases for a howdáh elephant. Below this hilly ground, the limit of which is pretty well defined by the Hátiwála road, the ground consists of a succession of small plateaux separated by the numerous Káns raus and their larger branches. Opposite Bháoria the plateaux end abruptly with very irregular contours, and then follows a belt of very low-lying, flat land, about half a mile broad, extending along the Súswa.

The highest and lowest points are respectively about 2,500 and 1,300 feet above the sea, the average elevation of the Hátiwála road being about 1,700 feet.

Soil and Underlying Rock.—Generally a rather stiff loam overlying alternating sandstones and conglomerates, with numerous interbedded bands of a reddish clay; most frequently stony in the hills, but everywhere suited for sál, except perhaps at the north-eastern extremity, where it is very dry.

Stock and Area.—The area is stocked as follows:—

		Acres.	
A.—Sál more or less pure	...	2,575	Most of the area below the Hátiwála road, but excluding the flat, low ground along the Súswa.
B.—Mixed sál with sain	...	2,020	Roughly the lower slopes, with portions below the Hátiwála road.
C.—Mixed sál without sain, but with inferior timber trees	...	2,840	The upper hilly portion, exclusive of the very dry soil along the main water-shed, and the portions under bamboo dovetailed with it.
L.—Mixed bamboos	...	454	Chiefly in the ravines in the interior of the Siwáliks and dovetailing with the preceding type.
N.—Scrub	...	520	In the low ground along the Súswa, and in the dry, stony soil near the water-shed line.
P.—Grassy blanks	...	310	Chiefly below the Jhabráwála-Kánsrau road.
Q.—Unproductive	...	555	
Total	...	9,274	

With the exception of the water-logged soil near the Súswa, sál is met with all over the block, being the predominant tree everywhere except on the dry soil near the water-parting. On the whole, the stock resembles, as regards age, height, density, quality, species and reproduction, that in the adjoining Jhabráwála block. The growth of grass, wherever the forest is sufficiently open, is heavy.

Recent History.—The whole of this block has been closed to grazing in the dry season and protected from fire since 1882. There is next to no grazing in it.

Accessibility.—Nearly every portion below the Hátiwála road is accessible to carts; while pack animals can go everywhere.

THE JÁMANKHÁTA BLOCK.

Situation.—This block occupies, besides the western portion of the northern slopes of the isolated Jámankháta hill, between the Súswa, Motichúr and Paniáli raus, the more or less flat ground between that hill and the easternmost Káns raus. On the north and east the Súswa separates it from the Nichla Song block and the Dehra-Hardwár road from the Uparla Súswa block; on the south the Ambiwála Sot divides it off from the Partítnagar block, and the main water-parting and the Kánsrau-Pardúni forest road from the Dánda block of the Motichúr forest; while on the west one of the Káns raus runs between it and the Bahera block.

Configuration and Aspect.—Besides what lies between the Paniáli and Káns raus, there is flat land a few hundred yards wide also along the Hardwár road. Above this latter belt the Jámankháta hill rises up suddenly with gradients varying from 15° to 40°, the height of the hill above the plain being only about 500 feet. The slopes are cut up by numerous ravines which all run north-east, some directly into the Súswa, others into a perennial stream which for nearly two miles runs parallel, but quite close to the Súswa before it meets that river.

Soil and Underlying Rock.—The soil is a sandy loam, often partaking of the nature of silt, and of very variable depth. The underlying rock is chiefly conglomerate and sandstone; and is never hard and compact enough to keep out the roots of trees. At the head of the Panoti rau the hill is composed of a dry, loose conglomerate which is suited chiefly for chir. Everywhere else the soil in itself is well adapted for sál, but becomes too wet for it along the perennial stream mentioned under the preceding head. On the flat but sloping

ground between the Paniáli and Káns raus sain can keep company with sál. Wherever the forest is open, the growth of grass is very rank.

Stock and Area.—The area is stocked as under :—

	Acres.	
A.—Sál more or less pure ...	574	The whole area between the Paniáli and Káns raus, the tongue of land forming the angle and the eastern extremity of the block excepted.
C.—Mixed sál without sain, but with inferior timber trees ...	210	The rest of the hilly ground, with the exception of the Panoti rau.
I.—Mixed chir ...	68	The head of the Panoti rau.
M.—Miscellaneous timber trees	1,570	All the low-lying, wet, flat land between the hill and the Hardwár road, which is not grass land.
P.—Grassy blanks ...	94	
Q.—Unproductive ...	250	
Total ...	2,766	

With the exception of the low, wet ground near the Hardwár road and the chir ground at the head of the Panoti rau, sál is found everywhere, growing fairly well, and forming with the companion species a stock of average density. The sál is chiefly in the condition of poles. The patch of chir is very open and badly grown. The belt of inferior species along the Hardwár road forms in most places a complete leaf-canopy permitting no grass to come up under it, and the species in it belong to the ever-green type of forest in the Dún. This is the only place where the *Pterospermum acerifolium* is found wild in the Division. In sál forest there are many places in which reproduction is very backward, due evidently to annual fires and the pronounced slope of the ground. Climbers, principally máljhan, are very abundant and destructive on the slopes.

Recent History.—This block has been protected from fire only since 1886-87. Owing to its proximity to the canal works,. it evidently suffered very considerably from overcutting before it came under the control of the Forest Department. There is no grazing in it.

Accessibility.—Although half the area is hilly, export will never be difficult, owing to its narrow width and the proximity of the Dehra-Hardwár road and the Motichúr Forest road.

The Uparla Súswa Block.

Situation.—This block forms the central third of the long river portion of the Kánsrau Forest, being situated between the Nichla Song block above and the Nichla Súswa block below. On the west and south-west the Hardwár road separates it from the Jámankháta block, while on the north-east it adjoins the block of Government waste land, and the private lands of Jogiwála and Sáhibnagar. It lies across the Súswa, taking in a portion of both banks.

Configuration and Aspect.—With the exception of a sloping piece of high ground, stretching from Kánsrau for about half a mile along the Hardwár road, this block comprises low banks and islands, and shallow channels consisting of the dry silt, shingle or boulder bed. The highest and lowest points are roughly 1,300 and 1,200 feet above the sea, thus giving an average fall of about 40 feet per mile.

Soil and Underlying Rock.—The soil is of the same composition as in the Nichla Song block, but owing to their lower situation, both banks, with the exception of the high sloping ground near Kánsrau, are even more water-logged than in that block. The growth of grass is extremely heavy and tall, in most places concealing a rider standing on his elephant.

Stock and Area.—The area is stocked as follows:—

		Acres.	
A.—Sál more or less pure	...	50	On the high, well-drained ground near Kánsrau.
F.—Sissu ditto	...	232	On the island to the left of main stream, which is more under the influence of the Song than the Súswa.
G.—Khair ditto	...	100	Chiefly further away from the main stream, and just beyond the sissu belt.
H.—Mixed sissu and khair	...	336	Mostly to the right of the main stream.
M.—Miscellaneous timber trees		105	Along the Hardwár road.
N.—Scrub	...	372	Elsewhere in all the soil that is not excessively water-logged.
P.—Grassy blanks	...	122	Principally the excessively water-logged soils.
Q.—Unproductive	...	364	
Total	...	1,681	

The belt of sál is very good and consists of tall, straight, well-grown poles, with nearly a complete advance growth on the ground. Some of the sissu patches are fairly good, but comprise chiefly young growth, although they contain more trees of some size than either of the two other river blocks of this forest. Otherwise the stock is very unsatisfactory, consisting of a few dense groups of forest growth scattered at wide intervals in the midst of seas of grass or scrub or boulder bed. There is a certain amount of young sissu reproduction here and there in the half consolidated silt, but it seems to be making very little headway.

Recent History.—This block has never been protected from fire, which sweeps every year through all the tall grass that it is the interest of the shikaries to burn, this being a part of one of the best shooting grounds in the Dún. Under the administration of the Department no green trees have been felled except in 1883-84, when 200 standing sissu, not less than four feet in girth, were sold. A certain amount of grazing goes on in the vicinity of Jogiwála and Sáhibnagar.

Accessibility.—Obviously, every point is accessible to carts. The average distance from the Ganges is less than eight miles, and from Máiápúr about 16 miles. During the greater part of the dry weather there is enough of water in the Súswa from here to the Ganges for the loose floating of small timber and wood.

THE NICHLA SÚSWA BLOCK.

Situation.—This is the lowest of the three river blocks comprised in the Kánsrau Forest. It takes in a continuous strip of the left bank of the river; but on the opposite side it extends only up to the line itself of the bank, which separates it from the Partítnagar block; and from the point where its boundary leaves that block at pillar 57 and follows that of the village lands of Partítnagar, it enters the stream, crosses the main channel, and then runs parallel to it down to Gohri, which is the eastern boundary of the block. On the north, the cart track from Khairi Kalán to Sidharwála separates it from the Ghamandpúr block of the Tírsál Forest, and cút lines mark it off from the private land of Sáhibnagar, Khairi Kalán and Khurd, and Thákurpúr.

Configuration and Aspect.—As in the preceding block, there being also a corresponding but much smaller well-drained high area at the western extremity of the block. But one important distinction must be made, which is that, whereas in the preceding block the main bed of the river runs through the middle of its length, in the present block it runs along one side, and the bulk of the productive area lies more or less in one mass intersected and drained by several narrow channels, the result being to render this block much more favourable for forest vegetation as well as for working and export. The ground falls from about 1,200 feet above the sea to 1,050, being an average of about 40 feet per mile.

Soil and Underlying Rock.—The nature of the soil and the underlying rock is the same as in the preceding block, but owing to the lower situation of the

block on the river, and to the added waters of the perennial stream of the Jámankháta block, and especially of the numerous perennial streams fed by the swamps near Jogiwála and Khairi, the soil is much wetter, but sufficiently well-drained to be capable of producing a dense forest growth. Wherever exposed, it covers itself with a very rank growth of grass.

Stock and Area.—The area is under the following types :—

	Acres.	
A.—Sál more or less pure ...	10	In the western corner along the Hardwár road.
C.—Mixed sál without sain, but with inferior timber trees	13	Along the same road in continuation of the preceding.
F.—Sissu	212	Chiefly in the northern portion to the left of the main bed, and continuation of the same type from the preceding block.
G.—Khair	110	Principally in the middle of the block along the channels which the Jákhan and Tawa Naddis add to the main river.
H.—Mixed sissu with khair ...	269	Along the same channel lower down, extending to the extreme end of the block.
M.—Miscellaneous timber trees	745	A long, broad belt between the main channel and the continuous belt formed by khair and sissu, pure and mixed; also a large patch occupying the very wet land between Khairi Kalan and Sáhibnagar.
N.—Scrub	125	
P.—Grassy blanks ...	180	Chiefly at the upper end of the forest.
Q.—Unproductive ...	418	
Total ...	2,082	

This block is much better stocked than the preceding, not only as regards the vegetation of the individual trees but also their collective density, the forest growth being nearly continuous from one end of the block to the other. In other respects the two blocks are similar.

Recent History.—If grazing, which although not very heavy in itself, is much heavier, be excepted, the present history of this block is, word for word, the same as that of the preceding block. Fires however have not been so destructive here on account of the moister soil, the much greater density of the forest growth, and its all lying in one piece.

Accessibility.—Carts can go all over the block, and there is an excellent and much-used cart track traversing it from Sáhibnagar to Gohri. The temporary dry-weather portion of the Dehra-Hardwár road runs along the main channel of the Súswa. The average distance of the block from the Ganges is less than three miles, and from Máiápúr about nine miles.

THE PARTÍTNAGAR BLOCK.

Situation.—This block lies along the same (northern) face of the Jámankháta hill as the block of that name, and extends round the corner at Gúlarghát over a portion of the eastern end. On the north it ends with the Hardwár road, which separates it from the Nichla Súswa block; on the east it is conterminous with the private lands, fairly well wooded, of Partítnagar; on the south the main ridge of the hill runs between it and the Dánda block of the Motichúr Forest; while on the west the Ambiwála Sot flows between it and the Jámankháta block.

Configuration and Aspect.—The contour of the slopes resembles that of the hilly portion of Jámankháta, and if the narrow hill-side overlooking Partítnagar be excepted, the aspect is the same. But the hill is rather higher, ascending to 1,924 feet above the sea, and rising from 550 to 700 feet above the plain below.

Soil and Underlying Rock.—As in the hilly portion of Jámankháta, but generally deeper and of better quality and more suitable for sál.

Stock and Area.—The area is stocked as follows :—

	Acres.	
C.—Mixed sál without sain, but with inferior timber trees	901	The whole hill side, except a belt of about a quarter mile along the water-shed.
L.—Mixed bamboos ...	267	
Q.—Unproductive ...	79	A belt of a quarter mile width along the water-shed.
Total ...	1,247	

Sál extends right up to the water-shed line, but is neither abundant nor well grown in the bamboo belt ; elsewhere, especially along the lower slopes, it is particularly fine, but is generally below middle age. Reproduction, owing to the severity of the annual fires due to the slope of the ground, is backward. Climbers, chiefly máljhan, are very abundant and destructive.

Recent History.—The usual tale of overcutting on account of the Ganges canal works has to be repeated here. Fire conservancy has not yet been undertaken. Grazing is practically *nil.*

Accessibility.—Owing to the short length of slope, carriage to the foot of the hill is not difficult. The Hardwár road flanks it on the north, and runs close to its eastern boundary. The average distance from the Ganges is just over three miles, and to Máiápúr about nine miles.

THE MOTICHÚR FOREST.

Situation and Concessions.—This forest is the most southerly portion of the Dehra Dún Division, and extends as far as Hardwár. On the north it is bounded by the Kánsrau Forest ; on the east by the private lands of Partítnagar and Raiwála and the forests of the Ganges Division in Garhwál ; on the south by the Chándi Forest of the same division in the Bijnaur district, by Láljíwála, and the Hardwár Municipality, both in the Saháranpúr district, and the Máiápúr block of the Saháranpúr Division ; and on the west by the Ránipúr, Rauli, Chhirak, Harnaul and Betban blocks of the same division. A portion of it lies astride the Ganges from Raiwála to Hardwár ; and enclosed between it and the rest of the forest, which occupies the Siwáliks and the southern face of the Jámankháta hill, together with an expanse of flat land between that hill and the Ganges, are the village lands of Haripúr Kalán and Khurd, Bhopatwála Kalán and Khurd, Chak Bhopatwála and Kharkhari.

This forest is free from all rights and concessions, but of course the road from Dehra to Hardwár must always remain open for the benefit of the public.

Configuration and Aspect.—The portions west of the Hardwár road, more than five-sixths of the total area, are divided by the great spur above Pardúni into two well-defined basins. The larger of these two basins (three times the size of the other) is that of the Motichúr rau and its feeders. It is a broad, open basin, the left side of which, formed by the southern face of the Jámankháta hill, rises up abruptly from the rau, while the other sides run up by easy gradients, often forming long plateaux-like ledges, and become steep only about half way up to the water-shed line. The second basin is drained by several independent, comparatively small streams, and contains very irregular ground with precipitous sides. The former basin is almost completely protected from hot winds by the great spur opposite Pardúni, while the second is exposed to their full brunt. The area east of the Hardwár road consists of a small expanse of low plateau, together with the river portion referred to under the preceding head, which portion comprises chiefly low islands in the Ganges. The highest and lowest points are respectively 2,431 feet and 940 feet above the sea, a total difference of level of very nearly 1,500 feet.

Soil and Geological Formation.—The soil is as varied as in the preceding block, except that there is no truly swampy ground here. Five-sixths of the area are suited for sál, more than half of this, all comprised in the Motichúr basin, being able to produce trees equal to the very best in the Dún. The rest of the hilly ground, including also the lower half of the Motichúr basin and the plateau land east of the Hardwár road, is adapted for the production of bamboo on a large scale. The river portion naturally contains every variety of silt suitable only for sissu and khair and the usual companion species.

Stock and Area.—The aggregate areas occupied by the various types of stock are as follow:—

	Acres.
A.—Sál more or less pure	4,698
C.—Mixed sál without sain, but with inferior timber trees ...	9,600
F.—Sissu	104
H.—Mixed sissu and khair	495
L.—Mixed bamboos	2,913
P.—Grassy blanks	1,533
Q.—Unproductive	2,730
Total ...	22,073

The quantity of stock is thus estimated:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	DIAMETER ABOVE 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound	Sound.	Unsound	
Sál	728,675	723,891	82,197	895	400	72	100	1,536,230
Sain	10,437	15,373	1,117	202	155	...	46	27,330
Sissu	11,948	17,352	868	7	10	...	...	30,185
Chir	637	1,581	416	230	87	25	25	3,001
Khair	2,080	1,903	25	...	...	...	...	4,008
Inferior timber trees ...	325,520	299,591	30,471	1,361	2,339	143	385	659,810
Inferior trees and shrubs ...	176,421	91,488	4,057	411	...	...	...	272,577
Bamboo clumps... ...	379,556	...	...	...	...	...	...	379,556
Totals ...	1,635,274	1,151,179	119,151	3,106	2,991	240	556	2,912,497

The stock in the river portion consists chiefly of mixed sissu and khair with the usual companions in such localities; but a very narrow strip of the evergreen sub-type of forest is found along the moist right bank of the Ganges. The basin of the Bágh rau and most of the flat land east of the Hardwár road contain bamboos mixed chiefly with inferior species, such as *Zizyphus*, chila, raini, bákli, &c. Everywhere else, about 18,000 acres, sál is to be met with, forming, if the crest of the spur above Pardúni be excepted, the greater portion of the crop. In the whole of the Motichúr rau basin generally its vegetation is excellent, and even in the most unfavourable portions exposed to the hot winds its growth scarcely falls below the average. Bamboo is very abundant all over the smaller of the two basins described above, over the portion of the other basin below the Kálákund rau and the Bari Jamni Dánda, and on most of the plateau ground east of the Hardwár road. Indeed the Motichúr forest is *par excellence* the bamboo forest of the Dehra Dún Division. Most of the bamboos in the smaller of the two basins flowered and died two years ago. Numerous

seedlings were produced everywhere, especially in the midst of the dead clumps where the seed was saved from being devoured, and the young plants from being trodden down or eaten up by cattle, and where alone the seeds found a good, loose, rich bed; but owing to grazing and other circumstances only a small proportion of the seedlings are surviving, although quite enough to form a good future bamboo forest. Most of the stock, owing to former over-cutting, is still in the stage of poles, and the bamboo clumps show the usual signs of weakness due to want of careful exploitation.

Recent History.—Owing to the proximity of population, and especially Hardwár, all the flat ground in the area is very heavily grazed over. Since the cold weather of 1883, the smaller of the two large basins (3,929 acres) has been closed to grazing and protected from fire, but nevertheless, open to the export throughout the dry, dangerous season, of fire-wood and bamboos for Hardwár. In 1885 fire-protection was extended to the Koelpura block, and subsequently in 1886 to the Dánda block and 60 acres, of bamboo plantation in the Johra Block. Out of the total area of 22,073 acres, 18,763 acres are under protection from fire. In 1882 the dry wood and bamboos were leased, but owing to the discovery of extensive frauds on the part of the lessee and establishment combined, the previously prevailing system of export by means of *rawannas* available to every one was reverted to. Until two years ago, green trees of the inferior kinds were allowed to be cut, to the very great injury of the forest. Hardwár and its vicinity being for ages a centre of a vast, although for the most part floating, population, this forest has borne the chief brunt of the export required to meet the constantly heavy demand, and the vicinity of the great waterway of the Ganges has only aggravated matters still further.

Accessibility.—In spite of the hilly ground west of the Hardwár road, very fair cart-tracks penetrate right into the interior, and in most places good feeders thereto in the shape of foot and bridle paths exist, or can be easily made. Every portion of the flat ground is approachable by carts. And, lastly, the Ganges, together with its great canal and the Hardwár road, both running through the forest, render it the most conveniently situated portion of the Dehra Dún Division, both for local and foreign export.

Component Blocks.—The area west of the Hardwár road is divided into three blocks, *viz.*, Dánda, Koelpura, and Kharkari, while east of that road the river portion forms of itself the Dúdhia block, and the low plateau ground another, the Johra block.

THE DÁNDA BLOCK.

Situation.—This block occupies the southern face of the Jámankháta Hill, and the plateau land which extends from the western extremity of the hill to the easternmost block of Kánsrau. On the north the main ridge of that hill, and the elephant track separates it from the Jámankháta and Partítnagar blocks of the Kánsrau forest, and the Kánsrau pass road from the Bahera block of the same forest; on the east the Hardwár road runs between it and the Johra block; and on the south and west the Motichúr rau, and a short spur divide it off from the Koelpura block.

Configuration and Aspect.—The southern slopes, generally rather steep and overhanging the Motichúr rau, of the Jámankháta Hill compose three-fourths of the area, the remaining fourth consisting of the plateau which extends to the head of the Panoti rau referred to under the Jámankháta block. The main ridge of the hill throws out numerous long spurs descending by easy gradients, so that there is a good foot-path along each. The deep, branched ravine of the Jámani rau drains the eastern half of the hill. The highest and lowest points are respectively 1,924 and about 1,000 feet above the sea, and the height of the hill is on an average about 650 feet above the Motichúr rau.

Soil and Underlying Rock—The soil at the head of the Motichúr rau is a rich, deep loam. On the slopes it is still a loam, but more sandy, stony, and dry. It is everywhere well adapted for sál. The predominating rock is sandstone. The growth of grass is heavy only on the plateau ground at the head of the Motichúr rau.

Stock ana Area.—The area is stocked as follows :—

	Acres.	
C.—Mixed sál without sain, but with inferior timber trees ...	4,085	The greater portion of the area.
L.—Mixed bamboo	155	Chiefly at the southern extremity along the lower slopes.
P.—Grassy blanks	386	Mostly in the low ground between the foot of the hill and the plateau.
Q.—Unproductive	201	
Total ...	4,827	

Sál is to be found almost everywhere, chiefly in the condition of small and middle-sized poles, and with it there is a sprinkling of sain. Chir is scattered along the upper crest of the hill. Inferior timber trees are abundant but never attain the same proportion as sál. Bamboo clumps are very numerous near the Pardúni Rest House, but are met with almost everywhere in the eastern portion of the block. As a rule, reproduction is rather backward, the result doubtless of the southern aspect and exposure to hot winds.

Recent History.—The whole of the block has been under fire-conservancy since 1886-87.

Accessibility.—From what has already been said, both here and in the description of the block, it is obvious that every point of the area is easily accessible for export. The average distance from the Ganges along the Motichúr rau is about four miles, and Máiápúr lies within nine miles.

THE KOELPURA BLOCK.

Situation.—The Koelpura block is situated entirely in the true Siwáliks, and comprises more than two-thirds of the Motichúr basin. On the north and east the Motichúr rau and a short spur separate it from the preceding block, and a long spur from the main ridge of the Siwáliks from the Bahera block of the Kánsrau forest ; while on the south a large spur divides it off from the Kharkari block, and the main ridge of the Siwáliks from the Ránipúr block of the Saháranpúr Division, and on the west, on the other side of the same natural feature, lie the Raula, Chhirak, Harnaul, Golna, and Betban blocks of that Division.

Configuration and Aspect.—The entire area is split up into natural divisions by numerous raus. The most important of these are the Panáráwála, Dádnáwála, and Kálákund raus and the Pirbakhsh and Bangalow sots, each of which constitutes of itself a large subordinate basin. The ground at the head of the main Motichúr basin is very hilly and rugged, while in the middle of that basin large plateaux extend from the rau right up to the foot of the hills. The hills are rugged and steep, but from the Kalákúnd rau southwards they become much more open and regular, and the crests of the main spurs there rise by easy gradients right up to the water-shed line. The general fall of the ground is of course eastwards, but the numerous spurs running out in every direction produce every variety of local aspect. The highest and lowest points are, respectively, 2,431 and about 1,000 feet above the sea, the maximum difference of level being as much as 1,400 feet.

Soil and Underlying Rock.—The soil is everywhere a sandy loam, deep and rich on all the plateaux, stony and more or less shallow elsewhere ; underlying, generally, loose sandstones and conglomerates that are easily penetrated by roots, especially in the portion south of the Kálákund rau. The Motichúr rau contains running water in half its course during the greater part of the dry season, and never dries up below a point near its junction with the Kálákund rau. The growth of grass can be heavy only in exposed places on the plateau and in the lower ground.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure ...	4,698	Covers nearly the entire area north of the Kálákund rau.
C.—Mixed sál without sain, but with inferior timber trees ...	4,463	Everywhere south of the Kálákund rau, except on the islands in the Motichúr rau and along the spur near Pardúni.
L.—Mixed bamboos ...	35	Along the spur near Pardúni and in patches in the lower ground along the Motichúr rau.
P.—Grassy blanks	680	Chiefly on the plateaux in the middle of the remains of the old fields of Koelpura.
Q.—Unproductive	700	
Total ...	10,576	

Sál is practically met with everywhere, and forms an excellent forest on the plateaux and extends upwards along the lower slopes, but it is nearly all in the low and middle pole stage. Bamboo is found from the spur near Pardúni right away to the Kálákund rau, this area being the richest bamboo tract in the Dún. Advance growth of sál is abundant in many places, but is, nevertheless, on the whole rather backward.

Recent History.—In addition to the heavy fellings effected before the advent of the Department for the canal works and for export generally, extensive depredations were carried on until recently by fraudulent purchasers and dishonest subordinates. The whole block has been under protection from fire since 1885-86.

Accessibility.—Carts cannot, of course, go beyond the foot of the hills, but the admirable position of the block, with regard both to markets and the river, renders export from every point cheap enough to be remunerative.

THE KHARKHARI BLOCK.

Situation.—This block forms the extreme southern portion of the Dún forests, and occupies the triangular ground between the main ridge of the Siwáliks, which separate it from the Ránipúr and Máiápúr blocks of the Sahárapúr Division, on the west and south, and the great spur above Pardúni, which forms the water-shed line of the Motichúr rau and separates the block from the Koelpúra block, on the north. On the east the boundary is a cut line dividing it off from the private lands of Haripúr Kalán, Bhopatwála Kalán, Chak Bhopatwála and Kharkhari, while about 400 yards of the Dehra-Hardwár road run between it and the Dúdhia block.

Configuration and Aspect.—The ridges which bound the area are much higher than all other points between them, and their sides are very steep, so that they close in a deep, broad basin drained by numerous watercourses, by far the largest of which is the Bágh rau, the next more important being the Súkh rau and the Amwála and Keláwála sots. Near the cut boundary line and along the larger watercourses the ground is open and flat, but soon becomes very rugged and steep. The drainage goes out eastwards directly into the Ganges, but the extreme irregularity of the surface produces every variety of local aspects, although northerly, westerly, and southerly exposures easily predominate. The highest and lowest points are respectively about 2,400 and 900 feet above the sea, being a maximum difference of level of 1,500 feet.

Soil and Underlying Rock.—In the flat, open places near the boundary, and along the larger water-courses, the soil is a sandy loam, fairly rich and moist in the northern half of the block, and everywhere suitable for sál. Elsewhere the soil is extremely dry and stony, and unsuited for sál. Grass grows heavily only on the better soils where the ground is flat and not overdrained.

Stock and Area.—The area is under the following types :—

	Acres.	
C.—Mixed sál without sain, but with inferior timber trees	919	Mostly along the Súkh rau, the Amwála sot and the upper branches of the Keláwála sot. There is a small patch behind Kharkhari.
L.—Mixed bamboos ...	2,403	All the rest of the area.
P.—Grassy blanks ...	76	
Q —Unproductive ...	289	
Total ...	3,687	

This is one of the worst stocked areas in the Dún, and, on account of the hot aspect, dry soil, and steep slopes, is also the least promising. The growth is extremely open, and not at all vigorous. Bamboo has been very abundant, either forming numerous, more or less large patches, or standing in the midst of crooked and badly grown khair, katber, and raini, with chilla, thanela, *Flacourtia*, kúra, *Randia*, ber, and a little haldu, bahéra, amaltas, &c. They had been extremely weakened by overcutting, and in 1883 and 1884 the majority seeded and died out. Bamboo seedlings are fairly abundant, chiefly in the dead clumps, but otherwise the state of reproduction in the forest is anything but encouraging.

Recent History.—This block has been closed and protected from fire since the cold weather of 1883. Being nearest the populous tract about Hardwár and Kankhal, it has suffered more than any other in the Dún from overcutting continued during generations and ages.

Accessibility.—Most of the sál area can be reached by carts, which can also go up into the interior along the main water-courses. This fact, together with the situation of the forest almost on the Ganges and at the very doors of the people, renders export from every point, even the least accessible, perfectly practicable.

THE DÚDHIA BLOCK.

Situation.—This is the portion of the Motichúr Forest which lies astride the Ganges. On the north it adjoins Ráiwála; on the east forests of the Ganges Division in British Garhwál and Bijnaur; on the south, Láljiwála and the Hardwár Municipality; and on the west the south-eastern corner of Kharkhari and the village lands of Chak Bhopatwála, Bhopatwála Khurd and Kalán, and Haripúr Khurd and Kalán.

Configuration and Aspect.—The very small portion of the right bank of the Ganges included within the boundary stands well above the river. All the rest of the land consists of islands of various sizes, the larger ones having winding streamlets running through them. Being silt-formed, they are all flat. The rapid stream of the river is constantly making slight changes, adding here and eroding there. The highest and lowest points are about 990 and 940 feet respectively above the sea, giving an average fall of about 11 feet per mile.

Soil and Underlying Rock.—The soil is naturally silt, of very variable depth, richness and compactness, and overlies boulders and shingle. Moisture is obviously always close to the surface. Many of the lower portions are annually flooded, and in any case there is no portion that does not become extremely wet during the rains. The growth of grass, though tall, is spare.

Stock and Area.—The area is stocked as follows :—

	Acres.	
F.—Sissu more or less pure ...	104	Principally two islands, one opposite Kharkhari, the other opposite the Chila Forest Chauki of the Ganges Division.
H.—Mixed sissu and khair ...	495	Most of the islands and the main land in the upper half of the block.
P —Grassy blanks ...	60	Chiefly the islands between the two preceding types, and between the second-type, and the left bank of the river.
Q.—Unproductive ...	1,465	
Total ...	2,124	

With the exception of the two islands under more or less pure sissu, the crop is very open and the undergrowth consists mainly of ber and khair, with, of course, grass. The sissu is nearly all young, chiefly in the pole stage, and is straight and well-grown. Seedlings of that species are coming up everywhere in patches in the loose silt. A few tún trees, and rather more jáman are found in the northern portion of the block. Recently, portions of the forest-bearing land have been washed away by floods.

Recent History.—Portions of the area in the northern part are rather heavily grazed over. No green trees have been cut since Departmental management; previously the cutting must have been very heavy. The island of Dúdhia, situated opposite Bhopatwála Chák and which gives its name to the block, is used as a station by the raftmen of the Ganges. Fires do not occur regularly.

Accessibility.—The most perfect accessibility of this forest is too patent to need remarks.

THE JOHRA BLOCK.

Situation and Concessions.—This block occupies, in one compact piece, all the main land east of the Hardwár road, which separates it from the Dánda block. On the north it adjoins the Partítnagar zamindári; on the east, Ráiwála and the Dúdhia block; and on the south, Haripúr-Kalán. The boundary between it and the private estates consists of cut straight lines, while that where it borders on the Dúdhia block is the line of bank of the Ganges.

Configuration and Aspect.—The whole ground is flat and forms part of a low plateau, the centre of which is a depression that becomes a tank during the rains and throughout the cold weather, whence the name of the block. A kachcha *band*, containing a large breach, still exists at the lower end of the tank. Near the southern boundary the plateau descends abruptly from 8 to 20 feet both towards the Motichúr rau and the Ganges. The Harna rau traverses it from end to end south of the tank. The highest point is in the north on the Hardwár road, and the lowest where the Harna rau leaves the block, the difference of level being hardly more than 100 feet.

Soil and Underlying Rock.—The soil is alluvial, a sandy loam, trodden down into a hard pan by the feet of cattle, generally shallow and immediately overlying boulders. Along the Hardwár road and the Harna rau and south of the latter, the soil is sufficiently well drained for sál; elsewhere it remains more or less water-logged during, and immediately after, the rains, and grass grows there luxuriantly.

Stock and Area.—The area is stocked as follows:—

	Acres.	
C.—Mixed sál without sain, but with inferior timber trees ...	133	A narrow belt along the Hardwár road and the Harna rau.
L.—Mixed bamboos ...	320	South of the Harna rau right down to the boundary, and north of it and east of the tank. Also a strip north of the tank.
P.—Grassy blanks ...	331	Occupies all the badly drained ground in the middle which is the abandoned site of old cultivation.
Q.—Unproductive ...	75	
Total ...	859	

In the sál belt the trees stand close together, and, although not up to the average of that species in the Dún, are, nevertheless, doing well. The strip of bamboo near the northern boundary is more or less pure; elsewhere the bamboo is mixed with khair, kúra, ber, *Ehretia*, &c., and with sissu and raini near the Ganges, and with here and there a haldu or a kaim. In the south-eastern corner, where the ground is moist and low, trees of swampy situations, such as *Cudrania, Bischoffia, Putranjiva*, &c., come in with a few *Terminalia Arjuna*, the only individuals of that species in the sub-Himalayan belt west of the Ganges, and perhaps even west of the Sarda, and most probably introduced by some ascetic

who squatted in the garden there. Two of these trees are very large. In this corner is a well in the middle of the site of an old garden. The bamboos and the inferior trees have suffered very considerably from overcutting.

Recent History.—The very large grassy blanks are due to extensive cultivation probably within the last quarter of this century. Grazing has always been very heavy; not only are the local herds numerous, but thousands of pack animals engaged in the carrying trade halt for the night or during the heat of the day at Pardúni. Until two years ago large quantities of fuel from evergreen trees were exported. In the middle of the block, on the road to Ráiwála, 60 acres have just been planted with bamboo 25′ × 25′ and protected from fire. The plantation promises well.

Accessibility.—Every portion of the area is accessible to carts, and, thanks to this fact and to the situation of the block between the Hardwár road and the Ganges and within six miles of Hardwár, every stick produced is saleable.

THE MÁLKOT FOREST.

Situation and Concessions.—The forest consists of three separate areas, the middle one of which, the largest, touches the other two only at only one point. It occupies the whole of the Kálimáti Hill, most of the Birási Hill and the western face of the Maidán Hill, together with some islands and a part of the bank of the Song river. It is situated about nine miles south-east of Dehra.

There are no rights or concessions of any kind in this forest.

Configuration and Aspect.—About a fourth of the area is flat ground lying either in or along the Song, or forming plateau land above the Birási grant and the village of Sirion. The remainder of the area is extremely hilly and steep. North-westerly, south-westerly, and south-easterly aspects predominate in about equal proportions. The highest and lowest points are respectively 4,410 and about 1,900 feet above the sea.

Soil and Geological Formation.—The portion in and along the Song contains sandy soil, which is generally very dry, and rests on shingle and boulders of hard sandstone and limestone. The remainder of the area is situated on the lower Himalayan formation consisting of quartzitic sandstones, schists, and shales, which often crop out on the scarps and steep slopes, where the generally free, sandy, dry, shallow soil is absent. On the two plateaux and in the deeper ravines, however, the soil is rich and loamy, and well adapted for sál, where the locality also is favourable.

Area and Stock.—The various types of forest growth occupy in the aggregate the following areas:—

	Acres.
A.—Sál more or less pure	34
B.—Mixed sál with sain	120
C.—Mixed sál without sain, but with inferior timber trees ...	219
D.—Mixed sál with inferior species alone	50
G.—Khair	17
H.—Mixed sissu and khair	603
M.—Miscellaneous timber trees	1,595
N.—Scrub	2,138
P.—Grassy blanks	112
Q.—Unproductive	753
Total	5,641

The stock is estimated as follows:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Totals.
	DIAMETER ABOVE 3" and up to 6"	DIAMETER ABOVE 6" and up to 12"	DIAMETER ABOVE 12" and up to 18"	DIAMETER ABOVE 18" and up to 24"		DIAMETER ABOVE 24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sál	69,746	71,354	7,665	743	100	108	36	149,752
Sain	5,280	8,365	2,460	552	66	275	45	17,043
Sissu	24,239	20,658	452	22	...	1	...	45,372
Chir	14	244	89	6	...	2	...	355
Khair	79,124	51,685	1,134	97	...	...	...	132,040
Inferior timber trees ...	102,078	242,397	40,349	6,287	1,590	1,741	1,261	397,703
Inferior trees and large shrubs	150,116	111,626	8,084	3,843	...	...	...	273,669
Bamboo	...	...	...	...	...	...	...	179
Totals ...	430,597	506,329	60,233	11,550	1,756	2,127	1,342	1,014,113

The islands and part of the low bank of the Song contain young, mixed khair and sissu with, in places, simal, haldu, *Moringa,* raini, &c. Sál is predominant on the two plateaux above Birási and Sirion, and in places on the south-eastern face of the Kálimáti Hill, which bears that species in less or greater numbers almost everywhere right up to its highest point (4,410 ft.). Otherwise the crop is formed chiefly of inferior species, the principal of these being bâkli, which, however, does not attain a large size or good form here, and semla, which is regularly tapped for gum. The sál portions are hardly above the stage of middle-sized poles, but are progressing fairly well. The same remark cannot be made of the stock on the hilly ground, which is generally open, often patchy, and always crooked and stunted. With the exception of young khair and sissu, which forms a more or less complete canopy, there is very much to be desired in the way of reproduction.

Present History.—With the exception of the limited portion south of the foot-path over the hill from Tháno to Birási, which has been closed and successfully protected from fire since the cold weather of 1883, and measures 720 acres, the whole of the area has always been open to grazing, and is burnt every year. Owing to the steepness of most of the ground, the grazing is heavy only in places. No fellings of green trees have been made here, except along the foot of the Kálimáti Hill for the lime-kilns in the neighbourhood. Dry wood, chiefly in the shape of firewood, has been taken out every year in small quantities under rawannas, and in 1884-85 the larger classes fit for tors were for the first time leased on the hillside above Sirion.

Accessibility.—This forest is the least accessible of any in the Dún, not only on account of its distance from Dehra and the Ganges (15 and 17 miles respectively) and the want of good roads, but also on account of its very hilly and steep character, requiring for the most part the produce to be carried down to the roads below on men's heads.

Component Blocks.—The river portion furnishes two blocks, *viz.*, Khachar and Saura Siroli, the Kálimáti Hill a third block of the same name as the hill, while the rest of the area constitutes the fourth or Sirion Block.

THE KHACHAR BLOCK.

Situation.—This is a very small block in the bed of the Song about 2½ miles south-east of Ráipúr, and touches the Saura Siroli block at pillar $\frac{1}{50}$. It adjoins, on the north, Ráipúr; on the east, cultivation and open forest of the Málkot Khat; on the south, Báláwála; and on the west Nathnawála. All the surrounding land bears forest of sissu and khair and of inferior species.

Configuration and Aspect.—The area comprises chiefly two flat low islands, which require no further description. The average height above the sea is about 1,900 feet.

Soil and Underlying Rock.—The soil is sandy and shallow, and overlies shingle and boulders of hard sandstone and limestone; good for sissu and khair.

Stock and Area.—The area is stocked as follows:—

	Acres.	
H—Mixed sissu and khair	... 181	Nearly the entire area of the two islands.
P—Grassy blanks	... 4	Principally the bed of the Song.
Q—Unproductive	... 43	
Total	... 228	

Most of the growth is under the middle pole stage. It is pretty dense.

Recent History.—Nothing special to note.

Accessibility.—This is the most accessible reserved khair and sissu area in the Dún, being only five and a half miles from Dehra along a fairly good cart track

THE SAURA-SIROLI BLOCK.

Situation.—This is another small block in the bed of the Song, and also includes the left bank up to the foot of the Kálimáti Hill. North of it lie cultivation and open forest of Khat Málkot; on the east the Kálimáti Block; on the south the Birási Grant; and on the west Báláwála. All the surrounding land is under forest.

Configuration and Aspect.—The portion in the bed of the Song consists chiefly of a single large island. The bank of the river is low and flat, and slopes up gradually north-eastwards to the foot of the Kálimáti hill. The highest and lowest points are about 2,000 and 1,850 feet above the sea, being an average fall of about 75 feet per mile.

Soil and Underlying Rock—As in the preceding block, except that the soil near the foot of the Kálimáti hill rests on sandstone. The growth of grass in the open is pretty heavy.

Stock and Area.—The area is stocked as follows:—

	Acres.	
H—Mixed sissu and khair	... 422	Islands in the Song and the angle between the Song and the Chitaur rau.
N.—Scrub	.. 222	Most of the rest of the bank.
P.—Grassy blanks	... 42	Some islands and an old field near Bhopálpáni.
Q.—Unproductive	... 290	
Total	... 976	

The khair and sissu forest resembles that in the preceding block. The rest of the stock consists of inferior trees growing fairly close together and sprinkled with sissu on the northern portion of the bank.

Recent History.—Nothing special to note beyond the fact that a great deal of lime is burnt here which requires a constant supply of fuel from the Government forest.

Accessibility.—Every portion is accessible to carts, which can either strike the Hardwár road at Harráwála, a little more than three miles off, or go direct to Dehra *viâ* Ráipúr, about seven miles off.

THE KÁLIMÁTI BLOCK.

Situation.—This block occupies the entire Kálimáti hill and stretches right across the loop formed by the Song. On the north it is bounded by the Song; on the east, partly by the cut line following natural features, partly by the Chitaur rau, separating it from the cultivation and open forest of Khat Málkot; on the south by the Chitaur rau, separating it from the Birási Grant; and on the west by the Saura-Siroli block, but principally by the Sarwargarh rau, separating it from the forest and open cultivation of Khat Málkot.

Configuration and Aspect.—The hill stretches south-west and north-east, so that one face looks north-west, the other south-east. The slopes are very steep, the ground rising in two miles from about 2,000 feet above the sea at the bottom of the hill to 4,410 feet at the top. Several large streams form deep basins inside the hill, *e.g.*, the Khairi rau, Baisrikhi Khála, &c.

Soil and Underlying Rock.—The soil is generally sandy and free, often absent and exposing the underlying sandstones and loose, soft slates. In places where the gradient is not too steep, or depressions exist, it is fairly rich, and, the situation permitting, suited for sál.

Stock and Area.—The area is stocked as follows :—

		Acres.	
A.—Sál more or less pure	...	34	In two or three patches on the sheltered plots of good soil high up the hill.
B.—Mixed sál with sain	...	120	Mainly two patches, by far the larger being the low ridge just above the Chitaur rau at the southern extremity, the other occupying a piece of good soil on the western face of the hill.
G.—Khair	...	17	Two very small patches in the bed of the Chitaur rau and Sarwargarh rau respectively, where these enter the Song.
M.—Miscellaneous timber trees		564	Principally in the basin of Baisrikhi Khála.
N.—Scrub	...	1,638	Practically the rest of the hill.
Q.—Unproductive	...	312	
Total	...	2,685	

Besides constituting the greater portion of the types A and B, sál is spread and scattered in the midst of inferior species over many portions of the hill, especially the higher ridges. It is never vigorous, and nowhere promises to attain more than moderate dimensions, if even that much. Advance growth of sál is fairly abundant in the large patch just above the Chitaur rau; elsewhere it is very unsatisfactory. Bákli is abundant on all southerly slopes, and extends all round the hill as scattered individuals, but new growth of it is conspicuous by its almost total absence. *Bauhinia retusa* is extremely abundant on all slopes which enjoy the requisite amount of shelter from excessive insolation. Every stem of it above a diameter of nine inches has been tapped for gum. On the whole, Kálimáti is, perhaps, area for area, the least valuable block in the whole Dún.

Recent History.—This block yields about one-quarter of the semla gum furnished by the Dún. It has never been protected from fire.

Accessibility.—This block is the most inaccessible portion of the Dún forests, as the average distance to the nearest point approachable by cart is more than two miles along very steep and rugged hillsides.

THE SIRION BLOCK.

Situation.—This block occupies, besides the greater portion of the hill above the Birási Grant, the south-west face of the Maidán hill. On the north and east lie the cultivation and open forest of Khat Málkot; on the south are private lands of Kakhnáwa Koti, Chauki, Ghandol, Sirion, the Lambirau block of the Tháno Forest and the Sámilkot Goth; and on the west the Birási Grant and Gáisen, and the Kálimáti block from pillar 43 to 72.

Configuration and Aspect.—With the exception of the two plateaux, one above the Birási Grant, the other above the Sirion village, all the rest of the area consists of very steep hillsides broken into several bays, the largest of which is formed by the Rehar and Sirion raus. South-westerly aspects, of course, predominate, but the slopes above the village of Kálimáti look west and those above Koti south and east. The highest and lowest points are respectively 3,952 and about 1,900 feet above the sea.

Soil and Underlying Rock.—As in the preceding block, with the addition of a rich, sandy loam on the plateaux.

Stock and Area.—The area is stocked as follows:—

	Acres.	
C.—Mixed sál without sain, but with inferior timber trees	219	The two plateaux.
D.—Mixed sál with inferior species alone ...	50	The upper slopes west of the Maidán bungalow and sides of the plateau above Sirion.
M.—Miscellaneous timber trees ...	1,031	Most of the other slopes.
N.—Scrub ...	278	Principally the sides of the other plateau.
P.—Grassy blanks ...	66	Chiefly about Maidán, the remains of old cultivation.
Q.—Unproductive ...	108	
Total ...	1,752	

The sál and sain forest on the plateaux is somewhat above the average quality for the Dún, but is generally very young; elsewhere, whenever it is found, sál is scattered, crooked, and stunted. All the rest of the forest growth is of a very inferior description, even bákli, which is very abundant, being crooked, knotty, and stunted. This wretched condition is due to the severity of the annual fires on these dry, steep slopes. Reproduction is nowhere forward. Climbers are generally rare.

Recent History.—No fellings have ever been made in this block since it has come under the control of the Forest Department. Dry timber in the shape of tors was sold from it for the first time in 1884-85.

Accessibility.—The better sál portions can be approached everywhere by carts. From the rest of the block produce can only come down on men's heads and, when landed at the foot of the hill, is 15 miles from Dehra and somewhat more from the Ganges.

THE THÁNO FOREST.

Situation and Concessions.—This forest occupies, besides the lower four miles of the Bidhalna rau, most of the flat land immediately below the Maidán hill between that rau and the Song. It is bounded on the north by the Rehar rau, which separates it from the Birási grant, by the Sámilkot gót, the Sirión block of the Málkót forest, and the private lands of Sirión, Koti, Kandogal, Rámnagar Dánda, Kudhál, Talái and cultivation and waste land of Khat Málkót; on the east by cultivation and waste land of chaks Málkót and Gadúl and the private lands of Kheri and Ránipokhri; on the south by the Jákhan block of the Tirsál Forest, Mr. Lister's Májri, and the Joli grants and Sangtiáwála Khurd; and on the west by Báronwála, Káluwála the Uparla Song Block of the Nágsidh forest and the Birási Grant. The adjoining portion of Mr. Lister's Grant is under scrub forest, the trees of which, however, belong to Government, or have been purchased by him from Government. Both the Joli and Birási Grants contain patches of sál and other timber, but the former Grant is coming rapidly under the plough. No rights or concessions of any kind exist

in this forest, but a long stretch, mostly of grass land, known as the Palási Tappar, and measuring 162 acres, is, by a purely Departmental arrangement, kept open to grazing throughout the year for cattle from the following villages: Koti, Chauki, Kondal, and Rámnagar Dánda, the inhabitants of which are required in return to assist in the fire conservancy of the forest, and to fire the grass in the tappar as soon as it is dry enough to burn, after first clearing a path round it.

Configuration and Aspect.—The greater portion of the area occupies plateau land, there being only a few low-lying patches along the western boundary, with about 1,200 acres extending over the bed, islands, and low banks of the Bidhalna rau. The whole drainage runs south-westwards, the greater portion of it going directly into the Song. The highest and lowest points are respectively 2,600 and 1,650 feet above the sea, being a maximum difference of as much as 950 feet in spite of the flat configuration.

Soil and Geological Formation.—With the exception of the Bidhalna rau portion, in which the soil is the usual silt found in such situations in the Dún, stiff clay predominates. A detailed analysis of this soil has already been given on pages 10 and 11 above. In spite of its clayey nature the remarkable fall of the ground enables sál to thrive on this soil. Whenever sufficient light reaches the ground the growth of grass is very heavy.

Stock and Area.—The various types of forest growth are distributed in the aggregate as follows:—

	Acres.
A.—Sál more or less pure	2,622
C.—Mixed sál without sain, but with inferior timber trees ...	1,444
D.—Mixed sál with inferior species alone	41
G.—Khair	48
H.—Mixed sissu and khair	797
M.—Miscellaneous timber trees	251
N.—Scrub	289
P.—Grassy blanks	408
Q.—Unproductive	676
Total ...	6,576

The entire stock, including all trees and shrubs over 34 inches in diameter, has been counted over the whole area, except that lying directly in the bed of the Bidhalna rau, the stock on which has been ascertained by means of sample plots.

The quantity of stock is thus estimated:—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sál	501,413	258,690	63,381	7,630	422	1,181	345	833,062
Sain	2,429	1,818	1,062	510	13	242	5	6,079
Sissu	25,435	17,514	1,019	117	...	...	8	44,093
Khair	9,302	48,835	754	24	...	...	...	58,915
Inferior timber trees ...	197,844	203,316	26,557	4,020	715	2,565	2,514	437,531
Inferior trees	184,341	39,469	680	87	...	...	...	224,577
Totals ...	920,764	569,642	93,453	12,388	1,150	3,988	2,872	1,604,257

If we omit the Lambirau portion, and some of the low-lying patches along the western boundary, the stock is composed mainly of sál, which grows vigorously over the greater extent of the area. In spite of this forest not having been worked to any appreciable extent during the last 27 years, the proportion of large sál trees is strikingly small. The reproduction of sál, except in the upper portions and in and near the patches of grass lands, is excellent. The sissu and khair forest is chiefly in the small pole stage, but is very promising. Climbers are very destructive in places.

Recent History.—Since 1877, the greater portion of the sál area has been closed against grazing during the dry season, and has also been protected from fire. In 1882, these measures were extended to the remainder of the sál area.

During the last 20 years for certain no heavy fellings have taken place in this forest; and since it has come under the Department, only a few hundred green, standing sál trees over 18 inches in girth have been felled, besides the few poles and small trees that have been taken out for Departmental purposes from 1880-81 to 1883-84. The minor produce and dead standing and fallen wood have been sold by lease. The great present and prospective value of the forest, and the extensive frauds which are necessarily perpetrated under the lease system, have resulted in the abolition of that system, and only such trees are now sold as have been previously marked by the Department; but minor produce is still removed under annual leases.

Accessibility.—This forest is placed almost midway between the Ganges and Dehra, but, in spite of carts being able to reach every point, the want of a good road, to tap it both in the direction of Dehra and connecting it with the Hardwár road, renders the export of anything but timber unremunerative, or, at least, extremely difficult and expensive.

Component Blocks.—The rau portion, with a part of the right bank, constitutes the Bidhalna block, while the plateau land is divided into the Lambirau and Rámnagar blocks by the Palási rau.

THE LAMBIRAU BLOCK.

Situation.—This block takes in the northern half of the flat ground in the Tháno Forest. It is bounded on the north by the Birási Grant, the Sámilkot Got, and the Sirion block; on the east by the private lands of Sirion, Koti, and Kandogal; on the south by the Palási rau, which separates it from the private lands of Rámnagar Dánda, and from the Rámnagar block; and on the west by Káluwála, the Uparla Song block, and the Birási Grant. The Palási tappar is situated at the south-western extremity of this block.

Configuration and Aspect.—The whole of the block is plateau land drained westwards into the Song by the Lambi, Palási, and Sirion raus, and one or two smaller streams. The extreme western portion, however, extends right down to the bank of the Song and the Rehar rau, and thus occupies low-lying, flat land unsuited for sál. The highest and lowest points are respectively about 2,600 and 1,700 feet above the sea, a total fall of about 900 feet in three miles.

Soil and Underlying Rock.—The soil is strongly clayey, containing about 50 per cent. of clay. It is generally deep, and overlies principally sandstones with bands of red clay interbedded. The soil is, on the whole, rich and well suited for sál. The growth of grass, wherever there is insufficient tree-cover, is tall and dense.

Stock and Area.—The stock is distributed as follows :—

		Acres.	
A.—Sál more or less pure	...	1,398	All the upper portion of the block, east of the Sirion rau, and the plateau in the angle of the Song and the Rehar rau.
C.—Mixed sál without sain, but with inferior timber trees		721	Most of the central portion of the block right down to Káluwála.
G.—Khair	...	48	One large patch along the Rehar rau, and two smaller ones lower down on the Song.
M.—Miscellaneous timber trees		61	In several patches, some on the low-lying flat near the Song, others in the vicinity of grass lands in the interior of the block.
N.—Scrub	...	27	In patches here and there.
P.—Grassy blanks	...	220	The Palási tappar and several smaller patches of apparently badly drained soil.
Q.—Unproductive ...	...	169	
Total	...	2,644	

This is pre-eminently a sál forest. That species, although abundant, does not, however, grow vigorously in the higher portion of the block, where the soil is rather shallow and very dry ; but in the remainder of the block the tree attains almost the finest dimensions and quality of which it is capable in the Dún. A complete enumeration of all stems, 3″ and upwards in diameter, has been made, which will give a better idea of the crop than any amount of verbal description. For the purpose of enumeration the block was divided into 36 plots, which have been grouped into 20 compartments, the areas and contents of which have been deposited in manuscript in the Divisional Office.

The reproduction of sál is sufficiently complete over the greater portion of the area, but is not satisfactory in the more open glades in the upper portion, and in and around the patches of grass land.

Recent History.—The whole of this block was closed to grazing, and brought under fire protection in 1879; but in 1882, recognising that the villages to the east of the block possessed insufficient grazing, the Palási tappar was thrown open on the terms explained higher up. The whole of this block was burnt in May 1882.

Green standing sál trees above 4′ 6″ in girth were sold to the manager of Mr. Lister's Grant in 1883.

Accessibility.—Carts can go over every portion of the block, and the silt and sandy beds of most of the raus constitute excellent ready-made cart-tracks. The average distance of carriage to the Song is barely two miles, and to Dehra about 12 miles along a fairly good route, which is, however, capable of very much improvement. The distance to the Ganges is about 17 miles.

THE RÁMNAGAR BLOCK.

Situation.—This block forms the central portion of the Tháno Forest. On the north the Palási rau separates it from the Lambirau block, and a cut straight line from Rámnagar-Dánda; on the east it adjoins the Bidhalna block; on the south the Joli Grant and Sangtiáwála Khurd; and on the west, Báronwála, Káluwála, the Uparla Song block and the Birási Grant. At its south-western corner it takes in a long, narrow, irregular strip of land between the Joli Grant on the one side, and Báronwála and Káluwála on the other.

Configuration and Aspect.—This block also consists of a low plateau terminating along the eastern and southern boundary, but also extends on the west beyond the edge of the plateau to the low, flat ground adjoining Káluwála

and Báronwála, which is quite unsuited for sál. The plateau is drained south-westwards by several long ravines, which disappear at the edge of the plateau. The highest and lowest points are about 2,300 and 1,650 feet respectively above the sea, being a total fall of about 650 feet in two and a half miles.

Soil and Underlying Rock.—As in the lower portion of the Lambirau block; hence, on the whole, better suited for sál.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A.—Sál more or less pure ...	1,224	Chiefly the western half of the plateau.
C.—Mixed sál without sain, but with inferior timber trees	546	The other half of the plateau.
M.—Miscellaneous timber trees ...	190	Along the edges of patches of grass land, and in the low ground opposite Káluwála.
N.—Scrub	113	Principally the long, narrow strips of irregular ground referred to above.
P.—Grassy blanks	72	Several badly drained patches both on the plateau and below.
Q.—Unproductive	104	
Total ...	2,249	

Leaving out the limited areas of low-lying ground, this block is more essentially a sál forest than the preceding one, and this solely on account of the more suitable soil, which also produces a more vigorous growth.

On the whole, the reproduction of sál is more satisfactory here than in the preceding block.

Recent History.—The entire area has been under fire protection, and closed to grazing during the dry months since 1880. It was completely burnt in May 1882.

Accessibility.—This block is more accessible to carts than even the preceding one, and although slightly further away from Dehra, is connected by means of a good forest road with the Dehra-Hardwár road.

The Bidhalna Block.

Situation.—This block comprises the bed and islands of the Bidhalna rau, from where that stream leaves the hills to a point near which it meets the Jákhan rau, and also the first terrace or plateau rising above the right bank. On the north a straight cut-line lies between it and the cultivation and waste land of Khat Málkot; on the east similar straight lines separate it from cultivation, the waste lands of Khats Málkot and Gadúl, and the private lands of Kheri, and the line of the bank from Ránipokhri; on the south the Lachhiwála-Ránipokhri road divides it off from the Jákhan block; and on the west a straight cut-line separates it from the Joli Grant, the edge of the second terrace or plateau from the Rámnagar block and from the private lands of Rámnagar-Dánda and Kudhál, and the edge of the first plateau from the villages of Talái and Kandogal.

Configuration and Aspect.—Half the block lies within the bed of the Bidhalna rau, while the other half occupies the immediate right bank of the rau as well as the first terrace above it. The rau runs nearly due north and south; the highest and lowest points are respectively about 2,600 and 1,900 feet above the level of the sea, being a total fall of about 700 feet in four miles.

Soil and Underlying Rock.—The long strip of plateau land forming the first terrace above the rau contains soil similar to that in the preceding block, but, obviously, shallower and less well adapted for sál. Elsewhere the soil is chiefly recently-formed silt, being sandy and containing a marked proportion of lime, and is the usual soil in which sissu and khair thrive in the Dún.

Stock and Area.—The area is stocked as follows:—

		Acres.	
C.—Mixed sál without sain, but with inferior timber trees	...	177	The long, narrow strip forming the first terrace above the rau.
D.—Mixed sál with inferior species alone		41	Patches in the midst of the preceding type.
H.—Mixed sissu and khair	...	797	Almost all the islands.
N.—Scrub ...	...	149	Chiefly the patches of low ground just below the steep banks.
P.—Grassy blanks ...	...	116	Includes several of the islands.
Q—Unproductive ...	...	403	Principally the boulder and shingle bed of the rau
Total	...	1,683	

The sál consists chiefly of small poles and forms, where it grows, nearly 50 per cent. of the crop; but it does not hold out much promise of attaining anything more than average dimensions. The sissu and khair are all young, and are coming on extremely well. Young sissu is suffering from over-grazing in the northern portion. A complete enumeration of the sál-bearing portion has been made, including every stem from 3″ in diameter upwards.

Recent History.—The plateau land containing sál forest (267 acres) has since 1882 been protected from fire, and closed against grazing during the period from 1st February to the setting in of the rains.

Accessibility.—Carts can circulate fairly everywhere, but the distance both from Dehra and the Ganges is, in the present state of the market, too great to admit of export beyond what will suffice to meet local requirements; while the quantity of limestone in the rau is too small ever to consume any considerable quantity of fire-wood.

THE TIRSÁL FOREST.

Situation and Concessions.—This forest extends from the Súswa, where the Jákhan joins it, northwards right up to Tihri-Garhwál, and from the right bank of the Jákhan eastwards as far as Rikhikesh. In the north, at one corner of the Jákhan rau it touches the Bidhalna block of the Tháno Forest, and in the south it abuts on the Nichla Súswa block of the Kánsrau Forest along the cart-track from Khairi to Sidharwála. Besides these Government estates, it is conterminous, for several miles on the south, also with a large block of Government waste land, and for about a mile on the west with a smaller similar block to which Mr. Lister has a right of pre-emption up to 1888. The private estates which border this forest are, on the north, Ránipokhri, Lysterpúr, Raynorpúr, and Barkot, and the Tihri Rája's territory, all separated from the forest by cut lines; on the east, the same foreign territory, the dividing line being principally the left bank of the Chandanáwa rau, and Rikhikesh, which is separated from it by a straight cut line; on the south, Bhátonwála, Garhi Khairi Kalán, Sidharwála and Jogiwála; and on the west the Joli and Mr. Lister's Grants.

An area of 72 acres (the village of Sainkot) belonging to the Tihri Rája is enclosed within the northern extremity of the forest, but is under our control under lease with the Rája.

The forest is entirely free of rights and concessions.

Configuration and Aspect.—The strips in the Jákhan and Chandanáwa raus comprise the usual flat, low islands with their containing shallow channels. The ground between the two raus consists of plateaux, ending more or less abruptly along the southern boundary, and, as a rule, cut up by numerous branched water-courses forming very deep ravines. The flattest ground is along the Chandanáwa rau and the upper part of the Jákhan rau. The highest and lowest points are respectively about 1,800 and 1,200 feet above the sea, being a total fall of 600 feet, and an average of about 75 feet per mile.

Soil and Geological Formation.—The soil in the rau portions is the usual silt overlying shingle and boulders. It is seldom deep, and is generally dry, except in the lower part of the Jákhan rau; elsewhere loams prevail, which are

sandy in the northern portion, but increase in stiffness as we go south, owing to a band of clay that comes close to the surface and crops out at the edge of the plateau along the southern boundary, thereby producing swamps. In the extreme southern corner the soil remains very moist near the surface throughout the year, and in many places along the rest of the southern boundary it is water-logged during part or the whole of the year. All the upper portion of the area between the outside raus is well suited for sál; that species being able to acquire at nearly every point the largest dimensions of which it is capable in the Dún. Below this, although sál can grow in most places, the soil is much more suited for inferior species. Sain finds a congenial soil almost everywhere. The crop of grass is heavy in all open places.

Stock and Area.—The aggregate areas occupied by the different types are as follow :—

	Acres.
A.—Sál more or less pure	4,436
B.—Mixed sál with sain	3,246
C.—Mixed sál without sain, but with inferior timber trees ...	2,419
F.—Sissu	451
H.—Mixed sissu and khair	918
M.—Miscellaneous timber trees	3,392
N.—Scrub	454
P.—Grassy blanks	1,474
Q.—Unproductive	1,276
Total ...	18,066

The quantity of stock is thus estimated :—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Totals.
	Diameter above 3" and up to 6"	6" and up to 12"	12" and up to 18"	18" and up to 24"		24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sál	974,013	360,710	56,261	15,325	731	4,233	2,216	1,413,487
Sain	11,643	8,911	5,841	1,302	82	674	144	28,597
Sissu	13,076	16,906	3,288	195	31	23	...	33,519
Khair	21,089	21,687	798	76	...	...	...	43,650
Miscellaneous timber trees ...	603,809	421,681	83,311	17,307	2,505	9,338	9,056	1,147,007
Inferior trees ...	320,724	129,558	5,326	375	...	...	...	455,983
Bamboos ...	241	...	...	...	...	...	...	241
Total ...	1,944,595	959,453	154,825	34,580	3,349	14,268	11,416	3,122,486

In the two large raus there is a good deal of sissu with khair and inferior species, the growth being chiefly in the pole stage. Bamboo is found in the Chandanáwa rau, and a little also in a few other places. In the wide southern angle included between these raus, trees of swampy and wet localities prevail, sál being completely absent. Here the growth is very dense in many places,

the evergreen sub-type of forest growth exists on a large scale, and large trees are to be found everywhere. The flat, low land along the Lálpáni rau is chiefly under grass, with a few scattered trees, such as dhák and others, capable of growing in water-logged soils. Excepting these, and a few other areas, the chief of which is near Rikhikesh, sál is to be met with everywhere, forming about 30 per cent. of the crop in the badly drained lower half of the forest, and being more or less pure elsewhere. The greater portion of the crop is in the pole stage, but there are more large trees both of sál and sain in this forest than anywhere else in the Dún. Both the sál and sain are vigorous and well-grown, and are also well represented in the advance growth, but there is plenty of room for more seedlings. Harra is abundant in the midst of the sál.

Recent History.—The forest has always been open to grazing, which is rather heavy in places along the boundary. Fire protection has never yet been undertaken, but no fires occur in the evergreen sub-type, and some parts are not burnt regularly every year. Heavy fellings of sál, as is proved by the great number of large stumps still to be found everywhere in spite of fires and decay, have not many years ago been made in this forest, much of it apparently before sufficiently honest supervision became available in the Department. In 1883-84, 500 sain trees above six feet in girth were sold standing. The dry wood and bamboos and minor produce, amongst which harra myrabolams figure to a large extent, have been leased annually since 1881.

Accessibility.—Every portion of the area is accessible to carts, and most of it is situated near enough to the Ganges for the remunerative export of firewood. Several good cart tracks traverse the area from north to south.

Component Blocks.—The Jákhan rau portion constitutes a single block of that name, while the rest of the area is divided into the following three blocks:—Ghamandpúr, Barkot, and Sainkot.

THE JÁKHAN BLOCK.

Situation.—This block is a narrow strip about half a mile wide on an average, and stretches for nearly nine miles along the Jákhan rau, embracing both its banks. It is conterminous with, on the north, the Bidhalna block of the Tháno Forest, the common boundary being the cart track from Lachhiwála *viâ* Ránipokhri to Rikhikesh; on the east, Ránipokhri, Lysterpúr, Raynorpúr and the Ghamandpúr block, the line of separation being the left bank of the Jákhan; on the soutn, Jogiwála with a cart line between; and on the west, a block of Government waste land and Mr. Lister's and the Joli Grants, the common boundary being here also cut lines.

Configuration and Aspect.—The configuration of the ground is of the well-known character peculiar to the sub-Himalayan streams which contain islands like the Song, &c. The highest and lowest points are respectively about 1,900 and 1,250 feet above the sea, a total fall of 750 feet, or an average of about 90 feet per mile, a fall great enough to prevent the Jákhan from spreading out very much here.

Soil and Underlying Rock.—Chiefly a sandy soil, never very deep, overlying shingle and boulders, and always comparatively well-drained; good for sissu, khair and its associates. Limestone is not abundant. The growth of grass is high wherever tree-cover is insufficient.

Stock and Area.—The area is stocked as follows:—

		Acres.	
F.—Sissu more or less pure	...	321	Chiefly in the southern half of the block; one patch at northern extremity.
H.—Mixed sissu and khair	...	718	Principally in the northern half of the block.
M.—Miscellaneous timber trees		43	One patch at the northern extremity.
N.—Scrub	...	148	For the most part in the southern half, occupying the ground left by the first type.
P.—Grassy blanks	...	22	Chiefly the middle portion of the large island in the south, the result of old cultivation
Q.—Unproductive	...	778	Includes mainly the beds of the various channels.
Total	...	2,030	

The forest is all young, most of it being in the low pole stage; sissu is the most widely distributed species, entering every type of growth. At the northern extremity báklí is very abundant. The vegetation is of about average vigour.

Recent History.—There has been no cutting of green trees in this block. Dry fallen wood has been annually leased since 1881.

Accessibility.—Carts can go about all over the area, but the distance of the greater portion of the block from markets and the neighbourhood of large private forests prevent a sufficient demand arising for fuel, the only produce which the block can at present yield.

THE GHAMANDPÚR BLOCK.

Situation.—This block lies between the preceding one and the rest of the forest. On the north it adjoins the private lands of Raynorpúr; on the east the Bangála rau separates it from the Barkot block; and on the south it abuts on the Nichla Súswa block of the Kánsrau Forest and is conterminous with the private lands of Bhátonwála, Garhi, Khairi Kalán and Sidharwála.

Configuration and Aspect.—The ground forms part of a plateau ending abruptly at the southern boundary, and cut up nearly everywhere by numerous deep, branched ravines running southwards to meet the Súswa. The principal watercourses are the Tawa Naddi, which runs in its lower course all the year round, and the Gula Naddi and its feeders. The highest and lowest points are respectively about 1,700 and 1,180 feet above the sea, an average fall of about 90 feet per mile.

Soil and Underlying Rock.—The soil is a sandy loam of considerable depth, immediately overlying shingle and boulders, but having a band of clay close to the surface in the southern half of the area, which produces the swampy ground just outside. The growth of grass in this rich soil is very heavy wherever the ground is sufficiently exposed.

Stock and Area.—The area is stocked as follows:—

		Acres.	
A.—Sál more or less pure	...	2 622	Chiefly in the open ground in the northern portion.
B.—Mixed sál with sain	...	1,165	Two patches immediately below the first type, one along the Tawa Naddi and the other along the Bangála rau.
C.—Mixed sál without sain, but with inferior timber trees	...	707	A patch between the two preceding types.
H.—Mixed sissu and khair	...	100	A strip along the low portion of the Jákhan.
M.—Miscellaneous timber trees	...	2,009	Nearly all the southern portion of the block.
N.—Scrub	...	27	
P.—Grassy blanks	...	375	Chiefly in two large patches, one near the northern boundary, the other in the middle of the southern half of the area.
Q.—Unproductive	...	134	
Total	...	7,139	

Owing to the unfavourable sub-soil, sál is absent from most of the southern half of the block, where the trees belong to species of swampy localities, such as *Trewia, Mallotus, &c.* Above this, where the sub-soil improves, sál enters at once as the predominant tree, with numerous sain in the lower half. The vegetation of both sál and sain is excellent. There are many more large sál and sain trees in this area than in any of the blocks hitherto described. The advance growth of sál is abundant in places, but on the whole not satisfactory. In the grassy area near the northern boundary, small suckers of áonla are very numerous.

Recent History.—Heavy recent fellings of large sál trees are testified to by the numerous dead stumps visible everywhere, which also prove what the soil can produce: 500 sain trees four feet six inches and upwards in girth were sold standing in 1883-84.

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Accessibility.—Every portion of this area is so perfectly accessible (numerous good cart tracks traversing it from end to end), and the distance from the Ganges is so short that firewood and inferior classes of timber can all be sold from it.

THE BARKOT BLOCK.

Situation.—This block, stretching from north to south over a length of upwards of six miles, lies between the Bangála and Lálpáni raus, which separate it respectively from the Ghamandpúr block on the west and the Sainkot block on the east, while a cart line separates it on the south from Government waste land. The private estates which adjoin it are—on the north, Barkot and Tihri-Garhwál; on the west, Barkot and Raynorpúr.

Configuration and Aspect.—As in the preceding block, with this addition that there is a long strip of very low-lying land along the Lálpáni rau.

Soil and Underlying Rock.—Also as in the preceding block, but with this exception, that the clayey nature of the sub-soil in the southern portion is more exaggerated, and the low ground along the Lálpáni rau is too water-logged to be fit for any real forest growth.

Stock and Area.—The area is stocked as follows:—

	Acres.	
A—Sál more or less pure ...	944	Nearly all the northern half of the block.
C—Mixed sál without sain, but with inferior timber trees ...	1,712	Most of the high ground below the preceding type.
N—Scrub	134	A narrow strip along the northern course of the Lálpáni rau and another along the Bangála rau.
P.—Grassy blanks	665	Chiefly the low ground along the Lálpáni rau.
Q.—Unproductive	167	
Total ...	3,622	

On the high ground in the southern portion of the block the stock consists chiefly of inferior species, such as dhák, jíngan, katber, khair, &c., with sál of average growth for the Dún scattered everywhere in varying proportion. The more or less pure sal area above this is as good as the best portions in Ghamandpúr.

Recent History.—The same as for the preceding block, if the extraction of sain trees be left out.

Accessibility.—On the whole more accessible than the preceding block, as the main export line is the Rikhikesh-Hardwár cart-track, which runs close to its boundary.

THE SAINKOT BLOCK.

Situation.—This is the easternmost block of the Tirsál Forest, being separated from the Barkot block on the west by the Lálpáni rau. Its other boundaries are:—On the north, Tihri-Garhwál; on the east, Tihri-Garhwál and Rikhikesh; and on the south, Government waste land. Immediately within its northern boundary is enclosed the Sainkot village (72 acres) belonging to the Tihri Rája.

Configuration and Aspect.—This block is much flatter and more even than the preceding, there being very few ravines in it. It is nearly all plateau land descending in the southern half in two or three terraces eastwards towards the Ganges and the Chandanáwa rau, which, with its numerous channels and included islands, runs just inside the eastern boundary.

Soil and Underlying Rock.—The soil is a sandy loam resting on Himalayan sandstone in the northern half, and on Siwálik sandstone and clay over the rest of

the area. Along the Lálpáni rau and in the middle of the block it is badly drained, and is not at all well suited for sál. The islands in the Chandanáwa rau contain chiefly sandy soil.

Stock and Area.—The area is under the following types:—

	Acres.	
A.—Sál more or less pure ...	870	All the high ground in the northern portion of the area, with the exception of a patch adjoining the village of Sainkot.
B. Mixed sál without sain, but with inferior timber trees ...	2,081	The middle portion of the block, exclusive of the Chandanáwa rau.
F.—Sissu	130	The islands in the lower course of the Chandanáwa rau.
H.—Mixed sissu and khair ...	100	The islands in the upper portion.
M.—Miscellaneous timber trees ...	1,340	Strips along the banks of the Lálpáni and Chandanáwa raus and a long patch on the flat ground near the eastern boundary.
N.—Scrub	145	Small strips along the two raus.
P.—Grassy blanks	412	Principally islands in the Chandanáwa rau and patches near the southern boundary.
Q.—Unproductive	197	
Total ...	5,275	

The sissu and khair are of a very inferior description. Sál is met with almost all over the area, and the stock which contains it, resembles similar growth in the preceding block.

Recent History.—No special remark necessary, except that sain trees were sold standing in 1884.

Accessibility.—Every portion of the area can be reached by carts, and the Ganges is on an average less than four miles distant from it.

TAPOBAN FOREST.

Situation and Concessions.—This is a very small strip of forest, about $\frac{3}{4}$ mile long and $\frac{1}{10}$th mile broad, situated in a gorge of the Ganges about a mile above Rikhikesh.

On the north and west, separated by the line of hills, lies the Tihri Rája's territory; on the east the religious zamindári of Tapoban; on the south and east the middle line of the Ganges forming the common boundary between it and British Garhwál; and on the south and west the religious zamindári of Rikhikesh.

The public possesses no rights or concessions of any kind.

Configuration and Aspect.—More than half the block consists of the bed of the Ganges, the remainder occupying the left bank of the river along the foot of the hills. The tract, although exposed to the south-east, is completely sheltered by a high range of mountains on the opposite bank.

Soil and Geological Formation.—The soil is sandy, overlying Himalayan shale and sandstones, and, combined with the situation, is not suited for sál.

Stock and Area.—The area consists of the following types:—

	Acres.	
M.—Miscellaneous timber trees	7	The north-eastern extremity of the bank.
N.—Scrub	14	The remainder of the bank.
Q.—Unproductive	21	
Total ...	42	

A complete enumeration survey of the stock has given the following results :—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above 3" and up to 6"	Diameter above 6" and up to 12"	Diameter above 12" and up to 18"	Diameter above 18" and up to 24"		Diameter above 24"		
				Sound.	Unsound.	Sound.	Unsound.	
Khair	17	40	6	...	...	...	..	63
Inferior timber trees	1,011	917	162	23	13	8	22	2,156
Inferior trees	881	211	8	5	...	...	...	1,105
Total ...	1,909	1,168	176	28	13	8	22	3,324

The stock in the northern portion is fairly dense and consists of a number of bákli trees ; elsewhere it is very miserable. The value of this forest is very small. With careful working it may supply a small proportion of fuel for lime-burning.

Recent History.—Extensive deposits of limestone, shingle, and boulders exist both above and below the forest, for burning which large quantities of fuel are necessary. The grazing is heavy.

Fire protection has never been undertaken, but fires are neither general nor destructive. At present the block is chiefly important for the control it gives over the river and over the working and management of the forests above, which have been leased from the Tihri Rája. The main pilgrim route to the shrines in the Ganges basin above passes through the forest.

Accessibility.—Most perfectly accessible by river, but no carts can reach it.

THE BIRBHADDAR FOREST.

Situation and Concessions.—This is also a narrow strip of land stretching for about three miles along the Ganges, midway (two miles distant) between Rikhikesh and Gohri.

On the north and west, separated from it by cut straight lines, is a large block of Government waste land ; on the east the middle line of the Ganges is the common boundary between it and British Garhwál, while on the south a straight cut line divides it off from the private lands of Kharak.

The public possesses no rights or concessions of any kind here.

Configuration and Aspect.—More than one-third of the entire area consists of the bed of the river. Of the remainder, upwards of one-half comprises flat, low islands, while only the rest lies on the main land, which is also flat and low-lying.

Soil and Geological Formation.—Silt overlying boulders and shingle ; totally unsuited for sál, but good for sissu.

Stock and Area.—The aggregate areas under the various types are as follow :—

	Acres.	
F.—Sissu	53	Principally the large island at southern extremity.
M.—Miscellaneous timber trees	13	Narrow strips along the bank.
N.—Scrub	6	A narrow strip along bank in northern portion.
P.—Grassy blanks ...	187	Principally islands.
Q.—Unproductive ...	188	Mainly the beds of the river.
Total ...	447	

A complete enumeration of the stock has been made, which has given the following results :—

Species.	CLASS V	CLASS IV	CLASS III	CLASS II		CLASS I		Total.
	Diameter above 3" and up to 6"	Diameter above 6" and up to 12"	Diameter above 12" and up to 18"	Diameter above 18" and up to 24"		Diameter above 24"		
				Sound.	Unsound.	Sound.	Unsound.	
Sissu	163	1,609	762	199	...	10	...	2,743
Khair	1	2	...	...	...	...	...	3
Inferior timber trees	239	405	93	32	6	18	19	812
Inferior trees	590	346	15	4	...	...	...	955
Bamboos	63	...	...	...	...	...	...	63
Total ...	1,046	2,362	870	235	6	28	19	4,566

The stock is very open and possesses very little present importance. The sissu will, however, later on become valuable, and a quarter of a century later also the firewood trees.

Recent History.—Grazing is very light. Fire conservancy has never been undertaken, but, thanks to the situation, fires are not general every year. The block is at present valuable more as offering a rest-by-the-way for raftsmen and for the collection of drift.

Accessibility.—Perfect. Hardwár is only about 12 miles by river.

PART III.

THE WORKING SCHEME.

CHAPTER I.

TREATMENT OF THE STOCK.

In the present condition of these forests no elaborate determination of the annual yield is possible. The extremely irregular condition of the stock and the abundance of crooked, unsound trees that have ceased to make any growth, or are in full decay, not only effectually prevent, but also render undesirable and unnecessary, any attempt at fixing the annual yield either in quantity of produce or even in number of trees. What is required is a series of operations by which all this unpromising portion of the stock will be taken out and, wherever necessary, also renewed by cutting back, before the generally excellent reproduction now coming on can be permanently injured by its presence or be badly damaged by its removal. Considered only from a sylvicultural point of view, the sooner this work is completed the better. But even if the necessary labour were available, and the demand large enough, it would be a mistake to suddenly flood the market for a few years, and then shut up or restrict the sources of supply for a more or less prolonged period until the forests could be worked again. It will, therefore, be necessary to work entirely on the basis of area and to spread the removal of the unsound, damaged, and unpromising portion of the stock over a term of 15 years, at the end of which time the uncut portion will contain a sufficiency of exploitable material not only to keep up the usual supply, but even to meet increased demands.

The treatment to be adopted should be of the simplest character, and whenever sylvicultural requirements clash with economical considerations, the former should prevail. One economical condition, however, imposes a necessary limit on the area that can be brought under treatment. Except near the Ganges, down which there is a large export trade in firewood, and in sissu and in bamboo forest, species other than sál and sain find little or no sale at all. Hence, save in the vicinity of the Ganges and in sissu and in bamboo forest, it is impossible to work any area in which those two species, either singly or both together, do not predominate. So that, with the three exceptions referred to, work cannot spread outside the tracts comprised under the types of growth designated A, B, C, and D, and even within these tracts there are many portions in which the forest is too open or the reproduction too backward to warrant fellings being made therein.

Hence there are only four classes of forest in which work can, for the present, be prescribed—

(1) Sál forest.

(2) Sissu forest.

(3) Bamboo forest.

(4) Forests of miscellaneous species situated within easy reach (up to about 8 miles) of the Ganges.

1.—Treatment of Sál Forest.

The system of treatment to be followed and about to be described is one that has been gradually worked out and elaborated in actual practice, and its efficacy has been fully demonstrated by the experience of the past five years.

Three several operations should be successively effected in each area to be worked :

I. First of all, two working seasons before any trees are felled, all climbers on trees should be cut. It has been ascertained by experiment that

large climbers take nearly two years to decay sufficiently to allow the attacked trees, when felled, to fall lightly and in any desired direction, and without dragging down with them neighbouring connected trees, which it is decided to maintain. The climbers should be cut close to the ground, and all organic connection with the soil should be destroyed. The latter precaution is necessary, as not unfrequently the lower portion of climbers, which trails along the ground, becomes rooted at one or more points.

II. During the working season immediately following that in which the climbers are cut, the trees to be felled should be marked. These trees should be sold standing, and hence none below 6 inches in diameter, unless it is dead or is not required to grow up again from the stool, should be marked. Unpromising poles, less than 6 inches in diameter and standing in the midst of insufficient reproduction, should be reserved for removal only in operation III, as otherwise the stool-shoots they may throw up are bound to be broken, or at least badly injured, in the felling, conversion, and export of the trees cut during the second season following that in which the marking took place. For easy recognition the trees to be felled should not only be stamped with the divisional hammer, but be marked with a broad ring of whitewash, which remains visible after at least two rainy seasons. The marked trees should be sold by public auction for a lump sum (to avoid disputes in case of any error in counting the number of trees), or at so much per unit of the respective classes of converted produce. If the latter method of sale be adopted, it will be necessary to prevent second-class timber being extracted before all that can furnish first-class timber has been converted; otherwise it will be the interest of the purchaser of second-class timber to cut up every log suitable for the higher class. Hence not less than two years will be required for the removal of all the trees marked for felling. If the trees are sold-standing for a lump sum, it will take one or two years to extract the marked trees according to the area of the coupe.

The trees in the different localities are of such unequal quality that in selling the whole coupe for a lump sum, the bidders at the auctions, unless several amongst them are mere rash speculators, would seldom be willing to offer more than the value of the worst class of trees. Hence, whenever practicable, the bidding should proceed on the basis of unity of converted produce. When this latter mode of sale is adopted, it may save much trouble and worry to invite sealed tenders instead of holding auctions.

The following trees, provided their removal is not opposed to sylvicultural considerations, should be marked—

(i) As a rule all sál and sain trees above 2 feet in diameter.

(ii) All smaller sál and sain down to 6 inches in diameter, which have ceased to grow, or are unhealthy, unsound, or about to become unsound, or are standing in an overcrowded condition, in contact with better-grown or more promising and valuable specimens of the same or other species.

(iii) Saving bar and other elephant-fodder yielding species, all trees and shrubs other than sál and sain, which are doing, or about to do, harm to better growth.

In marking the trees to be removed all stems belonging to species other than sál, sain and haldu, all which species command a ready sale under any circumstances, should be girdled so as to kill them. The removal of such trees is urgent in the interests of the growing crop, and if they cannot be sold with the rest, they must be got rid of in some way. When dead, if they are situated sufficiently close to Dehra or the Ganges, they may be sold as fuel, either in the lump to a single individual or firm, or in small quantities at a time by means of *rawannas* or passes. Should the proposed railway be constructed, the *whole* of this inferior wood would become valuable as fuel, and be disposed of without the slightest difficulty.

III. As soon as the work described under II has been completed and the coupe cleared of produce that it has been possible to dispose of at once, all the badly-grown, damaged, or otherwise unpromising saplings and poles (up to 6 inches in diameter) of sál and sain, wherever the remainder of the growing stock of valuable species is insufficient to form a complete crop, should be cut back flush with the ground in order to produce a sound, healthy, and vigorous re-growth. It is in view of obtaining such re-growth that it is undesirable to cut back poles more than 6 inches in diameter, and that the previous removal of all larger poles, that ought for sylvicultural considerations to come out, has been provided for under operation II.

Simultaneously with the work of cutting back, all overcrowded groups and patches should be thinned, undesirable species being weeded out. At the same time trees of inferior species actually injuring, or likely within the next 15 years to injure, more valuable individuals should be felled, girdled, or lopped according to the circumstances of the case; but this work should be done with caution where frosts are to be feared. In the present operation climbers should be cut over again, and in a much more wholesale manner than in the first operation, in which it was necessary to cut only such as had already begun to get up into trees and interfere with their felling.

In frosty localities, where the forest is open, it is useless to attempt any cutting back, as the new shoots are bound to get frost-bitten and in the end do no better than the original individuals. In such places the only resource left is to allow the original growth to gradually make its way up and ultimately form sufficient cover for new reproduction from seed.

2. Treatment of Sissu Forest.

Here the work should be limited—

(i) To the annual removal by jardinage of 40 trees 4½ feet and upwards in girth. This jardinage should be limited each year to one-fifteenth (about 200 acres more or less) of the area under sissu, which contains an appreciable number of first and second-class trees. The stock of such trees is estimated at about 600. Sissu being used in the Dún mainly for the manufacture of cart wheels, curved timber is just as valuable as straight pieces, and indeed more so where felloes are concerned. Hence there is no advantage in getting rid of the crooked trees of smaller girth than 4½ feet.

(ii) To the thinning out, independently of the jardinage, of over-crowded groups, sissu being a valuable as well as a pre-eminently light-demanding tree.

3. Treatment of Bamboo Forest.

If the bamboo clumps can be exploited departmentally, the preservation of all shoots less than two seasons old should, save for very special reasons, be rigidly insisted on: it is the only way of preventing deterioration and weakening of the clumps.

But departmental working is expensive and generally also results in a diminution of even gross receipts. Hence it may be found necessary to sell an entire coupe belonging to any year to a single purchaser. Restriction as to the age of the shoots and the height at which to cut them have failed to prevent overcutting wherever the demand for bamboos is at least equal to the production; as a consequence of overcutting, not only does the number of shoots produced by each clump fall off, but the size of these shoots diminishes from year to year. Hence, when a whole coupe is sold to a single purchaser, that individual should be bound to leave in each clump at least eight shoots of saleable dimensions and not to touch any clump which contains less than that number of such shoots. The reasons for imposing this condition on the purchaser will be found fully developed on pages 410-13 of my Manual of Sylviculture. The number of shoots to be left has been fixed at eight, as special countings made near Pardúni show that the average annual production per healthy clump is four such shoots. Further experience may require the number eight to be increased or diminished, but the general principle here laid down should not be departed from.

4. Treatment of Forests of Miscellaneous Species within easy reach of the Ganges.

Large quantities of fuel of all kinds are rafted down the Ganges and Ganges Canal to Rúrki and other large markets, and about 14,000 poles and logs of various inferior species are required every year for the canal headworks. This will enable us to work, in a much more wholesale manner than sál or sissu forest, the areas near the Ganges covered with miscellaneous species, such as the lower half of the Tírsál forest and the Jámankháta, and Uparla and Nichla Súswa blocks. These tracts should be worked as coppice with standards, and as frosts are generally severe there, the annual fellings should be made in long strips, following the direction of the main drainage lines and not exceeding 100 feet in width.

Should the projected railway be constructed within the current period of 15 years, the mode of exploitation here described could easily be extended by the executive officers to the same forest types in other blocks.

CHAPTER II.

THE WORKING CIRCLES AND PLAN OF WORK.

The forests prescribed for in this working-plan comprise too large and straggling an area to constitute a single working circle, and, as will be observed, they have been formed into seven distinct circles.

The forests situated at the two ends of the long valley of the Dún have their natural outlet towards the plains respectively by the Ganges route and by the Jamna river and the Timli pass first-class road. The forests at the Jamna end of the valley form by themselves a convenient working circle, but those on the Ganges side are extensive and important enough to be grouped into two separate compact circles.

The forests of the central portion of the Dún are situated within easy distance round the town of Dehra, which, as a market, absorbs a very large portion of their produce, the remainder going out directly by the Mohand pass first-class road, and also, but to a very small extent, by the Ganges and Jamna and Timli pass routes. These forests in the Western Dún can form only a single working circle, whereas in the Eastern Dún the Súswa is a natural boundary line between two large masses of them. That on the left comprises the Nágsidh and Tháno and Málkot forests. The first of these three forests is so different from the other two as regards the condition and age of its stock and its lines of export, that it has been made into a working circle by itself. Of the other two forests, the first consists mainly of old sál forests, while the second contains principally hill scrub suited at present only for supplying fuel for the lime-burners in the Song below, but they naturally constitute together a single working circle.

The subjoined table exhibits the division into working circles just explained:

Working Circle.		Component Forests.	Acreage under the various types.																Remarks.
Number.	Name.		Sál more or less pure.	Mixed sál with sain.	Mixed sál with principally inferior timber trees, excluding sain.	Mixed sál with low inferior species principally.	Sissu more or less pure.	Khair more or less pure.	Mixed sissu and khair.	Mixed chir.	Bamboos.	Miscellaneous timber trees without sál.	Scrub of inferior species.	Open thorny scrub.	Grassy blanks.	Unproductive areas.	Total acreage.	Aggregate acreage under sál.	
I	Jamna	Ambári	224	1,894	1,260	650	...	...	...	...	...	...	60	25		90	4,203	4,028	
		Chándpúr ...	316	...	...	1,591	...	...		...	...	...		66	67	208	2,251	1,910	
		Jamna	2,849	...	...	1,518	1	28	24	...	322	...	2,377	358	423	1,237	9,130	4,367	
		Timli	10,711	1,677	426	3,125	...	...	..	8	38	...	1,951		267	1,501	19,704	15,939	
			14,100	3,571	1,686	6,887	1	28	24	8	360	..	4,388	442	757	3,036	35,288	26,244	
II	Malhán	Dhaulkot	3,553	483	..	...	...	...	...	..	...	...		322	173	279	4,810	4,036	
		Sherpúr	7,504	1,301	2,953	...	...	...	...	18	...	...	746	...	388	1,012	13,922	11,758	
		Chandarbani ...	4,017	1,926	...	740	...	...	...	...	...	...	10	...	239	357	7,289	6,683	About 2,800 acres of sál forest already felled over or marked for felling.
			15,074	3,710	2,953	740	...	...	...	18	..	..	756	322	800	1,648	26,021	22,477	
III	Rámgarh	Rámgarh	2,318	4,483	719	895	...	...	...	...	...	205	687	...	461	714	10,482	8,415	About 4,700 acres of sál forest already felled over or marked for felling.
		Bulláwála ...	7,336	2,580	956	...	...	...	...	...	130	389	1,620	...	961	993	14,965	10,872	
			9,654	7,063	1,675	895	...	...	..		130	594	2,307	...	1,422	1,707	25,447	19,287	
IV	Nágsidh	Nágsidh	3,126	3,157	5,322	...	10	382	513	...	...	1,724	727	...	793	763	16,517	11,605	About 200 acres of sál forest already exploited.
V	Tháno	Málkot	34	120	219	50	...	17	603	...	...	1,595	2,138	...	112	753	5,641	423	
		Tháno	2,622	...	1,444	41	...	48	797	...	...	251	289	...	408	676	6,576	4,107	About 500 acres of sál forest already felled over or marked for felling.
			2,656	120	1,663	91	...	65	1,400	...	...	1,846	2,427	...	520	1,429	12,217	4,530	
VI	Tírsál	Tapobas	...	...	...	...	...	...	...	...	...	7	14	...	..	21	42		
		Birbhaddar ...	–	...	..	...	53	...	..	...	...	13	6	...	187	188	427		
		Tírsál	4,436	3,246	2,419	...	451	...	918	...	...	3,392	454	..	1,474	1,276	18,066	10,101	
			4,436	3,246	2,419	...	504	..	918	...	...	3,412	474	...	1,661	1,485	18,555	10,101	
VII	Pardáni	Kánsrán	3,209	2,020	3,964	...	515	1,033	1,209	68	721	2,420	2,359	...	1,034	2,388	20,9 0	9,193	
		Motichúr	4,898	...	9,600	...	104	...	495	...	2,913	...	...	...	1,533	2,730	22,073	14,298	
			7,907	2,020	13,564	...	619	1,033	1,704	68	3,634	2,420	2,359	...	2,567	5,118	43,013	23,491	

Note.—The present ranges should be reconstructed as follows:—

I. The Jamna range = the Jamna working circle

II. The Malhán range = the Malhán working circle.

III The Ramgarh range = the Rámgarh working circle.

IV The Lachhiwála range = the Nágsidh and Tháno working circles together

V. The Ganges range = the Tírsál and Pardáni working circles together

This arrangement will give each of the sanctioned rangers a separate charge. The two best and most experienced men should be posted to the Lachhiwála and Ganges ranges.

Little or no work will be done on the broken ground in the Siwáliks; the tree-growth there is usually very open and the little produce that could be obtained would seldom be remunerative. With this general remark the work to be carried out in each working circle will now be separately described :—

I.—The Jamna Working Circle.

Fellings will begin on the Jamna and progress successively eastwards. On the completion of work in the Sabháwála block, the Ambári forest will be taken up (beginning at the north-western extremity) and Chándpúr will follow last of all. The exploitation will be almost wholly confined to the sál and bamboo areas. These aggregate, respectively, about 26,000 and 360 acres. The bamboo area will, of course, be worked every year. Of the 26,000 acres of sál a very large proportion lies in the Siwáliks, and the exploitable area will be only about 18,000 acres, or an average of about 1,200 acres. A road from the Jamna along the boundary should be commenced at once: it is badly wanted both for export and inspection purposes.

II.—The Malhán Working Circle.

The present work, which was started from the Mohand road, will be continued to the further boundary of the Kaliánpúr block, after which the Dhaulkot forest will be taken up, beginning at the end nearest Dehra. Only the sál area will be exploited. The workable portion (all the ground below the Hátiwála road) comprises about 15,000 acres. Of this about 3,000 acres have been or are about to be completed, so that the average area to be taken up each year will be 800 acres more or less. A road serving for both inspection and export should be made at once along the boundary line from Karwápáni towards Sabháwálá.

III.—The Rámgarh Working Circle.

Save the exploitation of bamboos, nothing should be done above the Hátiwála road. Improvement fellings have been completed or are in progress over nearly the whole of the Rámgarh forest, only half of the Phándonwala block still remaining. The area of untouched exploitable sál forest is thus about 7,000 acres, giving about 500 acres per annum. Fellings over these 500 acres will not be very productive, since about half will comprise the compartments felled over under Mr. Greig's orders in 1876-78. The bamboo tract has been greatly overcut and should be closed for the next two years.

IV.—The Nágsidh Working Circle.

Only the sál and sissu areas will be worked. Of the aggregate of 11,500 acres under sál, nearly 4,000 acres are on hilly ground or are not in a condition to be exploited just at present. Over about 200 acres a heavy thinning has just been made. The annual coupe will thus extend over approximately 500 acres. A continuous sequence of coupes on the ground need be adopted here only to the extent that the condition of the reproduction will permit. The first coupe should be made on the west of the Mádhowála road near the *tappar* of that name. The exploitation of sissu will be confined to the mere operation of jardinage in the Uparla Song block (about 600 acres).

V.—The Tháno Working Circle.

In the Málkot forest overcrowded mixed sissu and khair crops will be thinned and light jardinage will be effected on the slopes overhanging the Song, if fuel for lime-burning in excess of what improvement fellings in the Tháno forest can supply is wanted. Otherwise only the sál areas will be worked. Of the aggregate of 4,500 acres of sál, about 600 acres are too backward to be taken in hand during the next 15 years, while 500 acres have already been exploited or are under exploitation, thus leaving about 200 acres to be treated every year.

VI.—The Tírsál Working Circle.

In this circle four different series of fellings will be simultaneously carried on : (i) improvement fellings in sál forest, (ii) and (iii), light jardinage and thinnings in sissu forest, and (iv) coppicing in the lower part of the area containing a crop of miscellaneous species—

(i) Of the aggregate area under sál, about 2,000 acres are not advanced enough to be worked, so that the annual coupe will extend roughly over 500 acres;

(ii) These fellings will go over the Jákhan and Bírbhaddar blocks (about 1,100 acres);

(iii) These thinnings will be undertaken over about 100 acres every year;

(iv) The aggregate area coming under this mode of exploitation is about 4,000 acres. We have no exact data to show what rotation is applicable here. We will nevertheless not be far wrong if, until more information is collected, we adopt a rotation of 20 years, thus obtaining annual coupes of about 200 acres each. The work should commence at the lowest end of the circle, near Khairi Kalán, and march progressively north-eastwards. Where the forest does not extend sufficiently far, in the direction of the strip to be felled, to give 200 acres in one piece, a second strip, at least 100 yards distant, should be cut to make up the balance. As a rule only straight and growing individuals should be reserved as standards; but where, owing to the absence or paucity of such stems, the ground would be uncovered too much, there other trees may be spared merely for protection against frost. To be on the safe side, the average number of standards per acre must not be less than 30. When the regrowth on any strip is complete and about 20 feet high, and not before then, a new strip may be cut alongside it. As the rotation comprises 20 years, it is obvious that at the end of the period for which this plan is drawn up there will remain about 1,000 acres still untouched.

VII.—The Pardúni Working Circle.

The work here will be similar to that in the Tírsál circle, with the addition of bamboo exploitation.

Out of an aggregate area of nearly 24,000 acres under sál, about 9,000 acres, owing to bad ground, backward reproduction, &c., will have to be excluded from working during the present period, leaving enough for an annual coupe of about 1,000 acres. The jardinage of sissu will be confined to the Nichla Song and the two Súswa blocks. The thinning out of overcrowded sissu will extend over roughly 120 acres every year, while the annual coppice coupe, starting from the lowest point of the Nichla Súswa block, and leaving out the upper part of the Uparla Súswa block and the steeper portions of the Jámankháta block, will embrace about 100 acres.

Summary of Work.

The following table gives the approximate acreages to come under the various fellings:—

Working Circle.	Acreage of annual coupes.				Total acreage of sissu forest to be worked by jardinage.	Remarks.
	Improvement fellings in sál forest.	Thinning in sissu forest.	Stored coppice exploitations in forest of miscellaneous species	Bamboo exploitation.		
Jamna ...	1,200	...	...	360*	...	* To have rest for the first two years.
Malhán ..	800	...	...	...	...	† To be treated as a single aggregate area, work to begin at the lowest end of the Nichla Súswa block, extend thence to the upper end of the Nichla Song block, and then pass successively through the Uparla Song, Jákhan and Birbhaddar blocks (*see* Treatment of Sissu Forest above).
Rámgarh ..	500	...	...	130*	...	
Nágsidh ...	500	...	...	...	600	
Tháno ...	200	80	...	...	...	
Tírsál .	500	100	200	...	1,100	*N.B.*—The acreages given in this table comprise only the productive areas that will fall within the actual limits of each coupe, which will also of course include grass land, stream beds, roads, and even forest, in which no work at all will be done.
Pardúni ...	1,000	120	100	3,610	1,300	
Total ...	4,700	300	300	4,100	3,000†	

The disposal of minor and miscellaneous produce and grazing should be regulated as hitherto, but on no account should dead, fallen wood inside the forests be farmed out, such wood being extracted in the shape of tors and fuel on *rawannas* or ticket-passes.

The plan of working prescribes only the removal of mature and deteriorating trees, and of such as actually interfere, or are about to interfere, with the favourable development of others more valuable than themselves. At the close of the 15 years the exploitable stock will not only consist principally of sound trees, but will be very much more abundant than what it is now.

CHAPTER III.

FIRE CONSERVANCY.

Fire conservancy should at once be extended to the remaining forests of the division, *viz.*, Ambári, Chándpúr, Málkot, Tírsál, and all the river blocks, many portions of which are flanked by natural barriers against the approach of fire.

A fire-trace ought to be cleared, in conjunction with the Sahâranpúr Divisional Officer, along the entire main crest of the Siwáliks, to prevent all risk of fire coming across from the other side. For this purpose a bridle-path, to form one edge of the fire-trace, should be made from the Ganges to the Jamna. Such a path was begun in 1884 and completed from Kharkari to the Kánsrau pass. To secure still greater safety the Hátiwála road should be continued in the direction of the Jamna, as far as the nature of the ground will allow.

A road being one of the best base-lines for a fire-trace, the road from Karwápáni to the Jamna should be made as soon as possible.

The compilation of a fire-conservancy map on the scale of 4 inches = 1 mile should be taken in hand without delay. This map should show every fire-trace. When a trace follows a road or water-course, it should be represented on the proper side of it. Not unfrequently, in order to take a short cut, or to get into grass that is easier to burn, or to utilise a natural barrier of evergreen bushes, &c., the fire-trace crosses a road and especially a winding water-course. As a permanent record for future guidance, all such vantage points and lines should be shown. The map should also exhibit water-courses, roads, paths, and other barriers, natural and artificial, not used as fire-lines, but offering special facilities for counter-firing; also, by means of arrows, the prevailing direction of the wind during the dangerous season. If different fire-traces are given different widths, this fact should be indicated on the map. Stations where fire-guards are posted should also be marked.

CHAPTER IV.

BUILDINGS AND COMMUNICATIONS.

With the work spread over every part of the division, it is evident that the supervising officers should be able to move about rapidly from place to place. For this good roads and comfortable rest-houses at convenient distances apart should be constructed.

The present rest-houses should be supplemented by one, in the style of that at Karwápáni, at each of the following places:—Near Sabháwála, at Tháno, at Jhabráwála, and between Khairi and Rikhikesh. Such bungalows, with their out-offices, ought not to cost more than Rs. 2,500. Small rest-houses, costing not more than Rs. 500, should be built at Jhájra, at Asárori, near Bulláwála, and at Kánsrau.

At Ambári and Barkot the Public Works Department bungalow can always be used when not occupied by the Canal Officers.

As regards roads, the Eastern Dún forests are already served by an almost complete network of them, all that is required being to construct a few feeder ones and to improve existing roads by cutting down steep gradients, rendering crossings easy by means of bridges, culverts, and other works, and consolidating

boggy places. In the Western Dún a good cart-road should be constructed at once along the boundary line of the forests from Karwápáni to the Jamna. Feeder roads abutting on this last should then be made as they are required.

CHAPTER V.

PLANTATIONS.

Natural reproduction of sál, sain, and the better from among the inferior timber trees is generally so good and so easily obtained that artificial regeneration is quite unnecessary, except in a single case, *viz.*, that of bamboo.

The demand for bamboo is enormously in excess of the production, and the vicinity of Hardwár gives a comparatively high market value to shoots only large enough for walking sticks. This circumstance, together with the peculiarity of bamboo that it flowers gregariously and dies, and that the next self-sown generation takes at least ten years to attain marketable dimensions, justifies the exception made in favour of that species. Nearly the whole of the Johra block is suitable for the growth of bamboo, although it at present contains only a small quantity of it. All that area, about 750 acres, should be planted up with seedlings from 1 to 3 years old, 15′ × 15′, at the rate of 50 acres per annum. The nursery at Pardúni should be kept up for this purpose.

CHAPTER VI.

FINANCIAL FORECAST.

Under the conditions on which this working plan is based, any kind of authoritative or trustworthy forecast of the financial position that the plan will lead up to is out of the question. Nevertheless, it is possible, on the basis of the previous working of the forests, to estimate approximately what the lowest net results will be. The actual position will certainly be considerably better than that shown in the following statement of probable *annual* revenue and expenditure:—

REVENUE.		EXPENDITURE.	
Particulars.	Amount.	Particulars.	Amount.
	Rs.		Rs.
4,700 acres of sál forest exploited in improvement fellings @ Rs. 17 ...	80,000	Improvement fellings over 4,700 acres @ Rs. 2	10,000
300 acres of sissu thinned @ Rs. 2 net	600	Temporary revenue establishments	7,000
		Charges on drift wood... ...	4,000
300 acres exploited as stored coppice @ Rs. 30 net (this includes the pieces of inferior species given for the Ganges Canal headworks) ...	9,000	Charges on live and dead stock ...	2,000
		Communications and buildings ...	6,000
4,100 acres exploited for bamboo @ Rs. 1·4 net	5,000	Plantations, 50 acres @ Rs. 20 ...	1,000
40 sissu trees @ Rs. 10 net ...	400	Protection from fire, 298 square miles @ Rs. 20	6,000
Dead fallen wood outside annual coupes	10,000	Miscellaneous items	5,000
		Permanent establishments and contingencies	23,000
Grazing grass and other minor produce	13,000	*Balance=surplus revenue* ...	64,000
Drift wood	10,000		
Total ...	1,28,000	Total ...	1,28,000

The following explanatory observations may be made in connection with the preceding statement:

(*a*) A large increase has been provided for temporary establishments, for improvement fellings, for stock and for fire-conservancy.

(*b*) The cost of the sanctioned subordinate establishments has been taken at its full sanctioned strength.

(*c*) The revenue per acre from the improvement coupes has been assumed to be only the same as the average first price actually obtained for the marked sál and sain trees standing; but revenue is also yielded by the inferior timber trees and by dead fallen wood, which have hitherto been sold separately by means of *rawannas*. Also see (*d*) below and the *nota bene* made in the column of remarks, page 111.

(*a*) Hitherto a considerable revenue has been realised every year from sale of sál, sain, bákli, harra, and jáman trees in different parts of the forests; in accordance with this working plan, the work will be confined to certain definite areas which will furnish the equivalent of those trees. This revenue has been omitted in the estimate [see (*c*) above].

(*e*) The revenue from grazing has been calculated at the present ridiculously low rates, although they ought at once to be *at least* doubled.

(*f*) The revenue here calculated excludes that obtained from the forests leased from the Rája of Tihri-Garhwál and from sale of produce from the Government wastes in the Málkot pargana and in the valley of the Eastern Dún, an aggregate of about Rs. 6,000.

SIMLA;
The 21st July 1887.

E. E. FERNANDEZ,
Offg. Deputy Director, Forest School.

APPENDIX I.

Section of rocks met with in sinking Cutcherry Well at Dehra.

Thickness in feet.	Total depth below surface in feet.	Soil.	Thickness in feet.	Total depth below surface in feet.	Soil.
5	5	Fine black mould, few stones	9	158	Sand, large pieces of conglomerate.
4	9	Reddish earth with gravel.			
9	18	Sand, gravel, large stones	4	162	Sand, enormous stones.
2	20	Sand, with reddish clay	6	168	Conglomerate and gravel.
3	23	Stiff, reddish clay	3	171	Sand, gravel, and conglomerate.
8	31	Stiff, yellow clay	3	174	Blocks of conglomerate.
3½	34½	Sand, gravel, little red clay	3¾	177¾	Sand, gravel, conglomerate.
1½	36	Stiff, reddish clay	4¼	182	Sand, gravel.
2	38	Sand and gravel	½	182½	Conglomerate.
22	60	Stiff, red clay	2½	185	Sand and clay.
2	62	Clay, sand and gravel	19	204	Loose sand and gravel, and large blocks, conglomerate.
16	78	Sand and gravel.			
12	90	Stiff, yellow clay with little sand	5	209	Sand, gravel, very moist.
35	125	Sand, gravel, few round stones	½	209½	Conglomerate over half.
6	131	Sand, large conglomerate blocks	1½	211	Red clay.
13	144	Sand, gravel, stones	7	218	Sand and gravel.
5	149	Sand, larger stones.	3½	221½	Brackish clay with angular fragment of clay state.

APPENDIX II.

PREVIOUS HISTORY OF THE FORESTS.

IN his "Memoirs of the Dehra Dún" (1874), Mr. G. R. C. Williams, C.S., writes as follows:

"From 1839-44 the right of collecting the duties on the timber exports was farmed to Atmágír, Mahant of Hardwár, for Rs. 33,500 a year. Everyone continued to hew away at the trees as he pleased, only paying certain dues to the farmer *in the event of the wood being exported.* The latter made his own arrangements to secure the collections at the different passes. Reckless waste was inevitable, and the fine sál forests began to disappear rapidly. The absence of conservancy was absolute. The district still abounded in old trees. Almost all these fell before the axe, and probably the rest would have gone with them had the roads been better. The consequences of this bad system are most perceptible in the Western Dún. In 1844 the Superintendent of the Dún, having ascertained that Atmágír was in the receipt of about Rs. 80,000 a year, discontinued the lease and kept the collection in his own hands. This arrangement lasted till 1855, when a kind of forest establishment was formed. In the interval the annual revenue from this source varied from Rs. 80,000 to 1,00,000, an income dearly purchased, for the destruction was something incalculable."

To this Mr. I. E. O'Callaghan, Deputy Conservator of Forests, added in 1878—

"There can be no doubt that sál, tún, and sissu were the trees chiefly felled, for even now there is no demand for any other kinds of timber; and when I entered the Department in 1864, the ground was everywhere studded with stumps of those trees."

After the free style of felling that prevailed up to 1864, it is obvious that restrictions could be introduced only very gradually, so that it would not be incorrect to say that real conservation began only after the close of the seventh decade of this century. All that was valuable had already been cut out, and since then the main duty of the Department has been to find a market for the unsound and mis-shapen trees left after the destruction of the forests, and to encourage reproduction and foster the new generation, which will not become exploitable for perhaps another century.

APPENDIX III.

Contents of Sál trees in Rámgarh Forest.

CLASS I—ABOVE 6′ IN GIRTH.

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber			Tops and billets.	Total.							
				In bole.	In branches.	Total.									
	Inches.	Feet.	Feet.												
1	100	74	40	91	...	91	4	95	not	measured.					
2	91	63	Hollow	...	...	...	8	8	132	140					
3	90	94	Forked	...	167	167	2	169	21	190					
4	90	90	Forked	...	127	127	7	134	37	171					
5	86	72	30	23	11	34	12	46	89	135					
6	84	92	10	34	67	111	4	115	49	164					
7	84	89	40	67	30	97	3	100	not	measured.					
8	84	74	50	56	36	92	...	92	not	measured.					
9	84	54	10	24	33	57	2	59	not	measured.					
10	82	68	40	60	12	72	7	79	not	measured.					
11	80	68	20	49	39	88	...	88	not	measured.					
12	80	75	20	48	30	78	6	84	not	measured.					
13	79	71	40	81	10	91	4	95	28	123					
14	79	64	50	66	...	66	...	66	not	measured.					
15	79	60	50	65	...	65	...	65	not	measured.					
16	79	63	10	26	31	57	1	58	not	measured.					
17	78	67	40	64	5	69	...	69	35	104					
18	78	64	10	23	43	66	5	71	not	measured.					
19	77	83	20	56	37	93	...	93	not	measured.					
20	77	81	10	26	61	87	...	87	not	measured					
21	77	76	Forked	...	76	76	2	78	not	measured.					
22	77	70	Hollow	...	...	...	5	5	97	102					
23	75	77	40	80	...	80	6	86	49	135					
24	75	77	10	26	52	78	2	80	not	measured					
25	74	80	50	68	...	68	4	72	not	measured					
26	74	80	40	65	...	65	6	71	not	measured.					
27	74	77	10	21	50	71	.	71	not	measured					
28	74	63	50	60	...	60	...	60	28	88					
29	74	65	50	48	...	48	3	51	not	measured.					
30	73	90	50	66	...	66	4	70	15	85					
Totals	2,408	2,221	790	1,293	927	2,220	97	2,317	580	1,437					
Averages	80	74	28	43	31	74	3	77	53	131	206	0·36	0·37	0·26	0·63

Contents of Sál trees.

CLASS II—ABOVE 4′-6″ AND UP TO 6′ IN GIRTH.

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.											
				Sawyers' timber			Tops and ballis.	Total.	Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole	In branches	Total.									
	Inches.	Feet	Feet												
1	72	94	Forked	...	108	108	22	130	...	...					
2	72	79	50	61	...	61	4	65	...	...					
3	72	76	30	36	...	36	22	58	49	107					
4	72	58	10	7	8	15	7	22	48	70					
5	69	70	Hollow	...	...	...	...	...	89	89					
6	69	89	50	61	...	61	5	66	...	...					
7	69	83	10	19	34	53	4	57	...	...					
8	69	63	30	18	...	18	15	33	49	82					
9	69	79	50	44	...	44	...	44	9	53					
10	69	70	Forked	...	45	45	...	45	...	...					
11	69	61	30	27	...	27	5	32	...	...					
12	68	76	50	54	...	54	4	58	...	...					
13	68	62	40	40	4	44	...	44	29	73					
14	67	73	Hollow	...	14	14	6	20	97	117					
15	67	81	50	53	...	53	...	53	...	...					
16	67	67	50	45	...	45	3	48	...	...					
17	67	61	30	27	4	31	...	31	...	...					
18	66	66	30	36	...	36	3	39	18	57					
19	65	92	10	19	50	69	17	86	26	112					
20	65	90	20	32	27	59	15	74	...	...					
21	65	58	20	34	5	39	...	39	19	58					
22	65	72	Forked	...	42	42	14	56	...	...					
23	65	64	30	34	...	34	11	45	...	...					
24	65	73	20	23	14	37	7	44	...	...					
25	65	64	30	33	...	33	8	41	...	...					
26	65	56	10	17	16	33	4	37	...	...					
27	65	54	30	19	...	19	4	23	...	...					
28	64	67	30	44	5	49	16	65	39	104					
29	64	70	10	17	23	40	18	58	26	84					
30	64	68	50	44	...	44	3	47	...	...					
31	63	87	30	45	9	54	...	54	17	71					
32	63	73	50	52	...	52	...	52	...	...					
33	63	66	Forked	...	43	43	7	50	...	...					
34	63	70	40	39	3	42	2	44	...	...					
35	63	60	50	33	...	33	3	36	...	...					
36	62	70	30	49	8	57	6	63	32	95					
37	62	63	40	44	...	44	...	44	15	59					
38	62	60	30	25	...	25	6	31	...	...					

Contents of Sál trees.

CLASS II—ABOVE 4′-6″ AND UP TO 6′ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.											
				Sawyers' timber											
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches	Total	Tops and ballis.	Total	Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet.	Feet.												
39	61	81	Forked	...	52	52	9	61	31	92					
40	61	76	10	17	32	49	7	56	...	...					
41	61	86	70	50	...	50	3	53	...	...					
42	61	76	40	34	...	34	15	49	...	...					
43	61	63	10	17	25	42	7	49	...	...					
44	61	70	50	41	...	41	6	47	...	...					
45	61	74	10	16	20	36	10	46	...	...					
46	61	74	50	43	...	43	3	46	...	...					
47	61	64	Forked	...	27	27	17	44	...	...					
48	61	61	10	13	21	34	8	42	...	...					
49	61	64	20	23	11	34	6	40	29	69					
50	61	66	40	36	...	36	4	40	...	...					
51	61	61	40	35	...	35	4	39	...	...					
52	61	65	20	9	...	9	11	20	48	68					
53	61	60	20	31	...	31	...	31	...	...					
54	61	57	30	23	...	23	8	31	...	...					
55	61	60	Forked	...	27	27	3	30	...	...					
56	61	54	20	23	...	23	6	29	...	...					
57	61	60	40	24	...	24	2	26	...	...					
58	60	71	20	25	9	34	8	42	18	60					
59	60	74	40	40	...	40	4	44	19	63					
60	60	61	40	30	...	30	3	33	...	...					
61	60	59	30	29	...	29	...	29	...	...					
62	60	64	30	24	...	24	...	24	...	...					
63	59	86	20	31	34	65	10	75	...	...					
64	59	86	10	18	30	48	14	62	...	...					
65	59	68	20	34	...	34	...	34	45	79					
66	59	66	20	27	16	43	2	45	25	70					
67	59	56	40	39	...	39	..	39	...	...					
68	59	63	40	34	...	34	4	38	...	...					
69	59	62	20	22	11	33	3	36	...	...					
70	59	66	40	32	...	32	...	32	...	...					
71	59	60	20	15	...	15	5	20	...	...					
72	58	56	30	30	...	30	...	30	28	58					
73	58	66	40	37	...	37	...	37	...	...					
74	58	66	50	34	...	34	3	37	...	...					
75	58	71	40	36	...	36	...	36	...	...					
76	58	56	40	27	...	27	3	30	...	...					
77	57	58	40	32	...	32	5	37	...	...					
78	57	62	40	24	...	24	8	32	...	...					

Contents of Sál trees.

CLASS II—ABOVE 4′-6″ AND UP TO 6′ IN GIRTH—*concluded.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				Sawyers' timber			Tors and ballis.	Total.							
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total.						Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet.	Feet.												
79	56	66	10	13	27	40	6	46	...	...					
80	56	76	50	32	...	32	8	40	...	...					
81	56	60	20	24	10	34	6	40	...	...					
82	56	59	10	14	19	33	3	36	...	...					
83	56	64	40	27	...	27	8	35	...	...					
84	56	62	40	29	...	29	4	33	...	...					
85	56	58	30	24	...	24	...	24	12	36					
86	56	56	30	18	...	18	9	27	...	...					
87	56	56	30	15	...	15	2	17	...	...					
88	54	72	20	24	16	40	...	40	...	...					
89	54	67	20	21	10	31	5	36	...	...					
90	54	66	40	31	...	31	4	35	...	...					
91	54	68	30	27	...	27	8	35	...	...					
92	54	69	40	30	...	30	4	34	...	...					
93	54	67	Forked	...	24	24	7	31	...	...					
94	54	64	30	27	...	27	...	27	...	...					
95	54	60	30	9	...	9	5	14	...	...					
Totals	5,849	6,424	2,660	2,551	883	3,434	521	3,955	817	1,826	...	...	...	...	...
Averages	62	68	28	27	9	36	6	42	34	76	113	0·32	0·37	0·30	0·67

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH.

1	54	61	10	14	15	29	10	39	...	...					
2	54	58	40	28	...	28	...	28	...	...					
3	54	51	10	12	13	25	...	25	...	...					
4	54	57	20	25	...	25	...	25	..	...					
5	53	63	20	21	12	33	7	40	33	73					
6	53	61	Forked	...	49	49	6	55	...	...					
7	53	68	50	44	...	44	...	44	...	...					
8	53	73	Forked	...	29	29	11	40	...	...					
9	53	70	30	30	9	39	...	39	11	50					
10	53	57	30	32	...	32	...	32	...	...					
11	53	56	30	22	...	22	8	30	...	...					
12	53	51	30	21	...	21	...	21	...	...					
13	53	61	30	15	...	15	5	20	...	...					
14	52	75	30	17	33	50	7	57	...	...					
15	52	61	40	32	...	32	14	46	...	...					
16	52	71	40	29	...	29	6	35	...	...					
17	52	60	Hollow	...	...	...	...	...	51	51					

Contents of Sál trees.

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel	Total volume of tree.		Sawyers' timber	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber			Tops and ballis.	Total.							
				In bole.	In branches.	Total									
	Inches.	Feet.	Feet.												
18	52	72	50	23	...	23	6	29	...	...					
19	52	57	30	16	...	16	11	27	...	...					
20	52	49	Hollow	...	...	...	8	8	37	45					
21	52	51	30	22	...	22	...	22	...	...					
22	52	58	20	18	...	18	...	18	...	...					
23	52	57	20	16	...	16	...	16	...	...					
24	52	48	20	16	...	16	...	16	...	...					
25	51	73	Forked	...	40	40	7	47	...	...					
26	51	73	40	30	...	30	11	41	...	...					
27	51	57	Forked	...	33	33	8	41	...	..					
28	51	65	40	32	...	32	...	32	10	42					
29	51	80	60	32	...	32	6	38	3	41					
30	51	81	50	33	...	33	3	36	...	...					
31	51	69	40	25	...	25	8	33	...	...					
32	51	59	40	20	...	20	4	24	...	...					
33	51	53	30	15	...	15	8	23	...	...					
34	51	51	10	12	11	23	...	23	...	..					
35	51	51	30	13	...	13	8	21	...	...					
36	51	47	20	18	...	18	2	20	...	...					
37	51	56	30	14	...	14	3	17	...	...					
38	50	79	40	27	...	27	14	41	...	...					
39	50	71	40	30	...	30	10	40	...	...					
40	50	71	40	26	...	26	3	29	...	...					
41	50	65	30	24	...	24	...	24	14	38					
42	50	71	40	24	...	24	3	27	...	...					
43	50	58	30	24	...	24	...	24	6	30					
44	50	73	30	24	...	24	...	24	...	...					
45	50	67	40	16	...	16	8	24	...	...					
46	50	45	20	17	...	17	...	17	...	...					
47	49	81	30	25	...	25	...	25	31	56					
48	48	58	10	13	16	29	6	35	...	...					
49	48	51	30	34	...	34	...	34	...	...					
50	48	58	Forked	...	23	23	11	34	...	...					
51	48	63	Do.	...	23	23	9	32	...	...					
52	48	76	50	23	...	23	6	29	...	...					
53	48	58	40	25	...	25	3	28	...	...					
54	48	58	40	25	...	25	3	28	..	...					
55	48	61	30	25	...	25	2	27	...	...					
56	48	58	40	24	...	24	3	27	...	...					
57	48	54	30	19	...	19	3	22	...	...					

Contents of Sál trees.

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.											
				Sawyers' timber					Fuel.	Total volume of tree.					
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches	Total.	Tops and ballis.	Total.				Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet	Feet.												
58	48	61	40	13	...	13	8	21	...	...					
59	48	52	30	13	...	13	8	21	...	...					
60	48	61	20	13	...	13	4	17	...	...					
61	47	58	40	26	...	26	2	28	...	...					
62	47	70	30	26	...	26	...	26	8	34					
63	47	59	40	25	...	25	3	28	...	...					
64	47	50	40	22	...	22	3	25	8	...					
65	46	61	10	15	8	23	...	23	28	...					
66	46	60	50	19	...	19	5	24	15	33					
67	46	61	40	13	...	13	6	19	...	51					
68	46	53	30	7	...	7	6	13	...	39					
69	45	83	40	26	...	26	12	38	...	...					
70	45	63	30	22	...	22	6	28	...	...					
71	45	51	20	16	...	16	4	20	...	...					
72	45	49	20	12	...	12	4	16	...	...					
73	45	51	30	12	...	12	5	17	3	20					
74	44	60	40	20	...	20	3	23	14	37					
75	44	64	30	24	...	24	...	24	11	35					
76	44	74	50	20	...	20	6	26	...	...					
77	44	65	40	18	...	18	7	25	...	...					
78	44	72	60	19	...	19	...	19	7	26					
79	44	54	30	12	...	12	8	20	...	...					
80	44	53	30	11	...	11	3	14	...	...					
81	43	66	20	16	...	16	8	24	25	49					
82	43	63	40	12	...	12	7	19	...	...					
83	43	54	30	13	...	13	4	17	...	...					
84	43	58	30	12	...	12	4	16	...	...					
85	43	49	20	11	...	11	5	16	...	...					
86	43	55	30	7	...	7	6	13	...	...					
87	42	51	30	19	...	19	...	19	...	...					
88	42	47	30	15	...	15	4	19	...	...					
89	42	48	30	6	...	6	6	12	...	...					
90	42	43	20	7	...	7	5	12	...	...					
91	42	53	20	6	...	6	3	9	...	...					
92	42	43	20	5	...	5	2	7	...	...					
93	41	58	30	13	...	13	6	19	...	...					
94	41	41	20	5	...	5	2	7	...	...					
95	40	53	10	9	10	19	12	31	...	...					
96	40	56	20	14	...	14	6	20	16	36					
97	40	53	30	18	...	18	4	22	...	...					
98	40	51	20	12	...	12	8	20	...	...					

Contents of Sál trees.

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*concluded.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber			Tops and billis.	Total.							
				In bole.	In branches.	Total.									
	Inches	Feet.	Feet.												
99	40	59	20	13	...	13	6	19	...	...					
100	40	49	30	12	...	12	3	15	...	...					
101	40	59	20	13	...	13	6	19	...	...					
102	39	59	30	14	...	14	6	20	...	...					
103	39	63	30	10	...	10	9	19	...	.					
104	39	53	30	11	...	11	4	15	..	...					
105	38	60	40	12	...	12	6	18	2	20					
106	38	48	20	12	...	12	4	16	...	...					
107	38	57	30	12	...	12	3	15	...	...					
108	38	53	30	6	...	6	8	14	...	...					
109	38	52	30	6	...	6	7	13	...	...					
110	38	43	20	10	...	10	...	10	...	...					
111	38	41	20	6	...	6	3	9	...	...					
Totals.	5,211	6,560	3,170	1,863	324	2,187	511	2,698	333	806					
Averages	47	59	29	17	2	19	5	24	16	40	56	0·34	0·43	0·28	0.71

CLASS IV—ABOVE 1′-6″ AND UP TO 3′ IN GIRTH.

1	36	42	30	12	...	12	3	15	5	20					
2	36	53	40	11	...	11	3	14	...	...					
3	36	48	20	6	..	6	7	13	...	...					
4	36	49	30	6	...	6	6	12	..	...					
5	36	47	30	6	...	6	6	12	.	...					
6	36	48	20	9	...	9	...	9	9	18					
7	36	46	30	5	...	5	4	9	...	...					
8	36	43	10	5	...	5	4	9	...	...					
9	36	49	20	5	...	5	3	8	...	..					
10	36	37	10	5	...	5	2	7	..	...					
11	36	34	10	5	...	5	...	5	...	...					
12	35	50	40	6	...	6	8	14	2	16					
13	35	39	20	...	...	..	6	6	...	...					
14	34	50	30	7	...	7	5	12	4	16					
15	34	49	30	5	...	5	6	11	...	...					
16	34	48	30	5	...	5	6	11	...	...					
17	33	68	30	5	...	5	6	11	4	15					
18	33	50	Hollow	...	...	...	...	...	15	15					
19	33	36	20	4	...	4	4	8	4	12					

Contents of Sál trees.

CLASS IV—ABOVE 1′-6″ AND UP TO 3′ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast-height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber.			Tops and hallis.	Total.							
				In bole.	In branches.	Total.									
	Inches	Feet	Feet.												
20	33	35	20	..	...	...	6	6	...	...					
21	32	40	30	7	...	7	4	11	4	15					
22	32	48	30	6	...	6	5	11	3	14					
23	32	43	30	5	...	5	3	8	...	...					
24	32	39	20	...	...	...	6	6	...	...					
25	31	51	30	6	...	6	7	13	3	16					
26	31	50	20	5	...	5	4	9	3	12					
27	31	43	30	5	...	5	4	9	...	...					
28	30	39	20	...	...	...	10	10	...	...					
29	30	48	20	3	...	3	4	7	4	11					
30	30	36	20	4	...	4	3	7	...	...					
31	30	37	20	...	...	...	5	5	...	...					
32	29	46	20	5	...	5	4	9	8	17					
33	29	45	30	3	...	3	6	9	4	13					
34	29	45	30	...	...	...	7	7	...	...					
35	28	42	20	...	...	...	7	7	6	13					
36	28	43	30	4	...	4	4	8	...	...					
37	28	35	10	...	...	...	8	8	...	...					
38	28	40	10	...	...	...	5	5	7	12					
39	27	32	20	...	...	...	7	7	6	13					
40	27	45	20	...	...	...	9	9	...	...					
41	27	43	30	4	...	4	4	8	...	...					
42	27	56	10	...	...	...	6	6	6	12					
43	27	32	30	...	...	...	6	6	6	12					
44	27	38	20	...	...	...	6	6	...	...					
45	27	38	20	...	...	...	5	5	...	...					
46	27	35	20	...	...	...	4	4	...	...					
47	26	36	20	...	...	...	5	5	5	10					
48	26	36	10	...	...	...	5	5	4	9					
49	26	33	20	...	...	...	4	4	...	...					
50	25	40	20	...	..	...	5	5	8	13					
51	25	38	10	...	...	...	4	4	5	9					
52	24	43	20	...	...	..	8	8	...	...					
53	24	32	20	...	...	...	4	4	3	7					
54	24	36	10	...	...	...	7	7	...	...					
55	24	36	20	...	...	...	3	3	...	...					
56	23	34	10	...	...	...	3	3	8	11					
57	23	36	10	...	...	...	3	3	5	8					
58	23	40	10	...	...	...	4	4	3	7					

Contents of Sál trees.

CLASS IV—ABOVE 1′-6″ AND UP TO 3′ IN GIRTH—*concluded.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree	Length of timber-yielding bole	Timber.					Fuel	Total volume of tree.		Sawyers' timber.	Timber of all kinds	Fuel.	Entire tree.
				Sawyers' timber			Tors and ballis.	Total.							
				In bole	In branches	Total									
	Inches	Feet	Feet.												
59	23	43	30	...	...	...	7	7	...	...					
60	22	48	10	...	...	...	3	3	4	7					
61	22	33	10	...	...	...	3	3	...	...					
62	22	31	10	...	...	...	3	3	...	...					
63	21	32	10	...	...	...	3	3	4	7					
64	21	33	10	...	...	...	3	3	...	...					
65	20	31	10	...	...	...	2	2	...	...					
66	20	30	20	...	...	...	2	2	2	4					
67	19	29	10	...	...	...	3	3	...	...					
68	19	31	10	...	...	...	3	3	...	...					
69	19	27	20	...	...	...	2	2	...	...					
70	18	23	...	...	...	...	3	...	3	3					
Totals	1,995	2,843	1,390	164	...	164	317	481	157	365					
Averages.	28	41	20	2	...	2	5	7	5	12	14	0·14	0·50	0·36	0·86

APPENDIX. IV.

Contents of Sál trees in Thâno Forest.

CLASS I—ABOVE 6′ IN GIRTH.

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel.	Total volume of tree.		Sawyer's timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber.			Tops and ballis.	Total.							
				In bole.	In branches.	Total.									
	Inches.	Feet.	Feet.												
1	82	90	60	60	11	71	...	71	125	196					
2	78	77	50	68	10	78	...	78	115	193					
3	78	82	60	57	8	65	...	65	77	142					
4	76	83	50	58	5	63	...	63	85	148					
5	73	81	60	53	7	60	...	60	49	109					
6	73	87	60	56	...	56	4	60	40	100					
Totals	460	500	340	352	41	393	4	397	491	888	...	...	...	...	...
Averages.	77	83	57	59	7	66	0·7	67	82	148	213	0·31	0·31	0·38	0·62

CLASS II—ABOVE 4′-6″ AND UP TO 6′ IN GIRTH.

1	72	70	40	50	...	50	...	50	43	93					
2	72	76	30	55	...	55	...	55	35	90					
3	70	81	40	50	...	50	...	50	66	116					
4	69	80	50	48	3	51	...	51	105	156					
5	69	86	40	30	...	30	9	39	88	127					
6	69	50	40	12	25	37	...	37	5	42					
7	68	80	30	29	11	40	...	40	87	127					
8	68	82	40	54	...	54	...	54	48	102					
9	68	80	30	40	...	40	...	40	54	94					
10	67	70	30	51	...	51	...	51	41	92					
11	67	78	40	39	...	39	...	39	50	89					
12	66	78	40	45	...	45	...	45	97	142					
13	66	78	60	34	7	41	...	41	33	74					
14	65	93	60	57	9	66	...	66	76	142					
15	65	81	50	46	...	46	...	46	86	132					
16	65	77	40	46	...	46	...	46	71	117					
17	65	92	60	52	7	59	...	59	43	102					
18	64	83	60	42	10	52	4	56	53	109					
19	64	79	50	36	...	36	...	36	24	60					
20	63	81	60	37	9	46	...	46	47	93					
21	63	78	40	40	...	40	...	40	43	83					
22	63	83	50	39	9	48	...	48	26	74					
23	62	83	50	60	...	60	...	60	66	126					
24	62	79	40	25	9	34	...	34	45	79					
25	62	60	40	27	6	33	...	33	12	45					

Contents of Sál trees.

CLASS II—ABOVE 4′-6″ AND UP 6′ IN GIRTH.

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				Sawyers' timber			Tors and ballis.	Total.							
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches	Total.						Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet	Feet.												
26	61	76	50	27	6	33	10	43	58	101					
27	61	76	40	47	...	47	...	47	53	100					
28	61	80	50	36	4	40	...	40	57	97					
29	61	80	40	37	...	37	...	37	54	91					
30	61	94	60	44	...	44	7	51	36	87					
31	60	77	50	49	...	49	...	49	46	95					
32	60	82	40	34	7	41	...	41	50	91					
33	60	76	40	41	...	41	...	41	42	83					
34	60	68	60	41	...	41	7	48	16	64					
35	59	70	60	45	6	51	...	51	48	99					
36	59	80	60	39	7	46	..	46	42	88					
37	59	82	60	37	9	46	...	46	39	85					
38	59	100	60	30	10	40	...	40	40	80					
39	57	72	30	55	...	55	...	55	40	95					
40	57	66	20	27	...	27	...	27	22	49					
41	56	76	50	31	6	37	3	40	36	76					
42	56	68	40	27	...	27	4	31	31	62					
43	55	73	40	27	...	27	4	31	44	75					
44	55	60	10	13	...	13	...	13	39	52					
45	55	60	10	14	...	14	..	14	37	51					
Totals	2,836	3,374	1,980	1,745	160	1,905	48	1,953	2,174	4,127					
Averages.	63	75	44	38	4	42	1	43	48	91	1·29	0·33	0·34	0·37	0·71

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH.

1	54	80	40	50	...	50	...	50	19	69					
2	54	77	20	32	...	32	...	32	37	69					
3	54	72	40	29	...	29	6	35	27	62					
4	54	60	30	32	...	32	...	32	8	40					
5	53	76	40	34	...	34	...	34	48	82					
6	53	72	20	30	...	30	...	30	35	65					
7	53	72	40	26	...	26	...	26	37	63					
8	53	77	50	34	...	34	4	38	22	60					
9	53	70	30	26	...	26	...	26	19	45					
10	52	79	60	35	7	42	6	48	37	85					
11	51	73	50	23	...	23	5	28	23	51					
12	51	74	20	31	...	31	...	31	18	49					

Contents of Sál trees.

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				Sawyers' timber			Tops and ballis.	Total.							
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches	Total.						Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches	Feet.	Feet												
13	50	70	30	34	...	34	...	34	26	60					
14	50	73	40	19	...	19	7	26	27	53					
15	48	75	40	23	...	23	...	23	35	58					
16	48	74	40	39	...	39	...	39	16	55					
17	48	66	30	25	...	25	...	25	15	40					
18	48	68	20	22	...	22	...	22	13	35					
19	47	65	30	29	...	29	...	29	22	51					
20	45	69	30	25	...	25	...	25	21	46					
21	45	76	30	24	...	24	...	24	16	40					
22	45	69	30	19	...	19	7	26	12	38					
23	45	50	10	6	..	6	...	6	14	20					
24	44	70	40	25	..	25	5	30	9	39					
25	44	65	40	26	...	26	4	30	4	34					
26	43	60	30	28	...	28	.	28	13	41					
27	43	55	30	15	...	15	3	18	10	28					
28	42	60	20	15	...	15	...	15	15	30					
29	42	65	30	18	...	18	3	21	8	29					
30	42	34	10	7	...	7	...	7	2	9					
31	40	64	20	13	...	13	2	15	6	21					
32	40	58	20	13	...	13	..	13	5	18					
33	40	52	20	7	...	7	5	12	6	18					
34	39	75	40	17	...	17	8	25	12	37					
35	39	60	20	18	...	18	...	18	16	34					
36	39	55	10	10	...	10	...	10	13	23					
37	39	48	20	7	...	7	..	7	13	20					
38	39	63	20	11	...	11	...	11	8	19					
39	38	50	20	14	...	14	...	14	10	24					
40	38	64	30	12	...	12	2	14	9	23					
41	38	32	Hollow	...	...	...	...	...	7	7					
42	37	34	10	8	...	8	8	16	3	19					
Totals	1,920	2,701	1,200	911	7	918	75	993	716	1,709					
Averages	46	64	29	22	...	22	2	24	17	41	58	0·37	0·40	0·30	0·70

CLASS IV—ABOVE 6″ AND UP TO 3′ IN GIRTH.

1	36	59	40	9	...	9	11	20	9	29					
2	36	69	20	13	...	13	5	18	11	29					
3	36	62	40	15	...	15	6	21	6	27					

Contents of Sál trees.

CLASS IV—ABOVE 6″ AND UP TO 3′ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				Sawyers' timber			Tors and ballis.	Total.				Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total.									
	Inches.	Feet.	Feet.												
4	36	60	10	6	...	6	4	10	7	17					
5	36	43	...	..	...	...	...	...	15	15					
6	36	64	30	...	...	...	3	3	11	14					
7	35	38	...	...	...	...	...	...	11	11					
8	34	62	20	...	...	...	12	12	8	20					
9	34	64	10	6	...	6	9	15	4	19					
10	34	50	30	16	...	16	...	16	2	18					
11	34	60	30	...	...	...	9	9	8	17					
12	34	40	30	8	...	8	3	11	3	14					
13	34	52	20	6	...	6	5	11	2	13					
14	34	50	30	7	...	7	4	11	2	13					
15	34	55	...	...	...	...	...	...	12	12					
16	34	48	20	...	...	...	8	8	4	12					
17	34	22	20	5	...	5	4	9	2	11					
18	34	40	10	6	...	6	...	6	3	9					
19	33	66	30	6	...	6	8	14	8	22					
20	33	61	30	11	...	11	3	14	7	21					
21	33	48	...	...	...	...	...	...	11	11					
22	32	68	20	5	...	5	6	11	7	18					
23	32	50	10	8	...	8	...	8	7	15					
24	32	54	30	5	...	5	6	11	3	14					
25	32	50	20	6	...	6	2	8	6	14					
26	32	37	...	...	...	...	...	...	13	13					
27	32	30	10	...	...	...	6	6	7	13					
28	32	40	10	...	...	...	6	6	5	11					
29	32	40	20	5	...	5	3	8	3	11					
30	31	50	2	6	...	6	2	8	4	12					
31	31	56	...	...	...	...	...	...	10	10					
32	30	56	30	6	...	6	8	14	3	17					
33	30	56	20	6	...	6	4	10	6	16					
34	30	60	40	...	...	...	12	12	2	14					
35	30	63	30	...	...	...	9	9	5	14					
36	30	56	30	...	...	...	11	11	3	14					
37	30	52	20	...	...	...	6	6	6	12					
38	30	42	10	3	...	3	3	6	2	8					
39	29	53	20	5	...	5	4	9	7	16					
40	29	52	30	...	...	...	9	9	2	11					
41	28	50	40	...	...	...	13	13	2	15					
42	28	56	20	5	...	5	4	9	5	14					
43	28	56	30	...	...	...	9	9	4	13					

Contents of Sál trees.

CLASS IV—ABOVE 6″ AND UP TO 3′ IN GIRTH—*continued.*

Serial number of tree	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree					
				Sawyers' timber.			Tops and ballis.	Total							
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total						Sawyers' timber.	Timber of all kinds	Fuel	Entire tree
	Inches.	Feet.	Feet.												
44	28	59	20	...	...	...	8	8	4	12					
45	28	55	10	...	...	...	6	6	6	12					
46	28	50	20	...	...	...	8	8	2	10					
47	28	55	10	...	2	2	3	5	5	10					
48	28	55	20	...	...	...	8	8	3	11					
49	28	40	10	...	...	...	5	5	4	9					
50	28	36	20	...	...	...	7	7	1	8					
51	28	42	20	...	...	...	5	5	2	7					
52	28	45	20	...	...	...	6	6	1	7					
53	28	45	...	...	...	...	...	...	7	7					
54	28	56	...	...	...	...	...	...	3	3					
55	27	60	20	...	...	...	8	8	4	12					
56	27	60	20	...	...	...	7	7	5	12					
57	27	46	20	5	...	5	2	7	4	11					
58	27	58	30	...	...	...	8	8	2	10					
59	27	35	...	...	...	...	...	...	10	10					
60	27	39	...	...	...	...	...	...	8	8					
61	27	50	...	...	...	...	...	...	8	8					
62	27	41	...	...	...	...	...	...	7	7					
63	27	45	10	...	...	...	4	4	2	6					
64	27	36	20	...	...	...	...	...	5	5					
65	26	56	...	...	...	...	...	...	15	15					
66	26	59	20	...	...	...	8	8	6	14					
67	26	61	20	...	...	...	6	6	5	11					
68	26	52	10	...	...	...	4	4	6	10					
69	26	55	30	...	...	...	8	8	2	10					
70	26	36	20	...	...	...	6	6	3	9					
71	26	49	20	...	...	...	5	5	3	8					
72	26	52	20	...	...	...	5	5	3	8					
73	26	50	20	...	...	...	6	6	1	7					
74	26	37	...	...	...	...	...	...	8	8					
75	26	38	...	...	...	...	...	...	7	7					
76	26	40	...	...	...	...	...	...	6	6					
77	26	45	...	...	...	...	...	...	4	4					
78	25	55	30	...	...	...	9	9	3	12					
79	25	47	20	...	...	...	6	6	4	10					
80	25	53	...	...	...	...	...	...	5	5					
81	24	50	30	...	...	...	7	7	1	8					
82	24	51	20	...	...	...	5	5	5	10					

Contents of Sál trees.

CLASS IV—ABOVE 6″ AND UP TO 3′ IN GIRTH—*continued.*

Serial number of tree	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth	Reducing factor for			
				Timber.											
				Sawyers' timber											
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total.	Tops and ballis.	Total.	Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet.	Feet.												
83	24	58	20	...	...	...	5	5	4	9					
84	24	56	20	...	...	...	4	4	5	9					
85	24	46	20	...	...	...	6	6	3	9					
86	24	50	30	...	...	...	8	8	1	9					
87	24	47	30	...	...	...	7	7	2	9					
88	24	41	20	...	...	...	5	5	3	8					
89	24	38	10	...	...	...	3	3	5	8					
90	24	48	20	...	...	...	7	7	1	8					
91	24	60	20	...	...	...	5	5	3	8					
92	24	36	10	...	...	...	3	3	5	8					
93	24	56	20	...	...	...	4	4	3	7					
94	24	48	20	...	...	...	6	6	1	7					
95	24	30	30	...	...	...	6	6	1	7					
96	24	38	...	...	...	...	...	...	6	6					
97	24	40	...	...	...	...	...	...	6	6					
98	24	50	20	...	...	...	5	5	1	6					
99	24	36	...	...	...	...	...	...	5	5					
100	24	37	...	...	...	...	...	...	5	5					
101	24	38	...	...	...	...	...	...	5	5					
102	24	35	...	...	...	...	..	...	3	3					
103	24	15	Hollow	...	...	...	...	...	2	2					
104	23	48	20	...	...	...	6	6	3	9					
105	23	40	20	...	...	...	4	4	3	7					
106	23	50	30	...	...	...	6	6	1	7					
107	23	38	20	...	...	...	5	5	2	7					
108	23	52	...		...	...	...	...	4	4					
109	22	48	20	...	...	...	6	6	3	9					
110	22	50	10	...	...	...	3	3	4	7					
111	22	42	10	...	..	...	3	3	4	7					
112	22	46	...	...	..	...	...	...	6	6					
113	22	36	..	...	...	...	...	...	6	6					
114	22	35	..	...	...	...	...	...	5	5					
115	22	40	...	...	...	...	...	...	4	4					
116	22	35	...	...	...	...	...	...	4	4					
117	22	25	10	...	...	...	2	2	2	4					
118	22	42	...	...	...	...	...	...	4	4					
119	22	33	...	...	...	...	...	...	3	3					
120	22	35	...	..	...	...	...	...	2	2					
121	22	18	...	...	.	...	...	..	1	1					
122	21	43	...	...	...	...	...	...	7	7					

Contents of Sál trees.

CLASS IV—ABOVE 6″ AND UP TO 3′ IN GIRTH—*concluded.*

Serial number of tree	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.						Total volume of tree.					
				Sawyers' timber			Tors and billis.	Total.	Fuel			Sawyers' timber	Timber of all kinds.	Fuel	Entire tree
	Girth at breast height.	Height of tree	Length of timber-yielding bole.	In bole	In branches	Total									
	Inches.	Feet	Feet.												
123	21	40	10	...	...	...	2	2	4	6					
124	21	44	...	...	...	...	...	...	5	5					
125	21	40	10	...	...	...	2	2	3	5					
126	21	50	10	...	...	...	2	2	3	5					
127	21	32	..	...	...	...	...	...	4	4					
128	21	50	10	...	...	...	2	2	2	4					
129	21	36	...	...	...	...	...	...	2	2					
130	21	28	...	...	...	...	...	...	2	2					
131	20	40	...	...	...	...	...	...	6	6					
132	20	34	10	...	...	...	3	3	3	6					
133	20	50	...	...	...	...	...	...	5	5					
134	20	39	...	...	...	...	...	...	4	4					
135	20	30	10	...	...	...	2	2	2	4					
136	20	35	10	...	...	...	2	2	2	4					
137	20	33	...	...	...	...	...	...	3	3					
138	20	22	...	...	...	...	...	...	3	3					
139	20	36	...	...	...	...	...	...	3	3					
140	20	39	...	..	...	...	...	...	2	2					
141	19	40	...	...	...		...	...	7	7					
142	19	40	20	...	...	...	3	3	2	5					
143	19	32	...	...	...	...	...	...	3	3					
Totals	3,784	6,583	1,012	179	2	181	504	685	646	1,331					
Averages	27	46	20	1	0	1	4	5	5	10	16	0·06	0·3	0·3	0·6

CLASS V—1′-6″ AND BELOW IN GIRTH.

1	18	35	20	...	...	...	5	5	1	6					
2	18	32	18	...	...	...	2	2	2	4					
3	18	36	20	...	...	...	2	2	2	4					
4	18	35	20	...	...	...	2	2	1	3					
5	18	34	12	...	...	...	2	2	1	3					
6	18	35	12	...	..	..	2	2	1	3					
7	18	22	10	...	...	...	1	1	1	2					
8	18	23	12	...	...	...	1	1	1	2					
9	18	24	12	...	...	...	1	1	...	1					
10	18	23	12	...	...	...	1	1	...	1					
11	17	51	40	...	...	...	6	6	1	7					
12	17	45	20	...	...	...	3	3	1	4					
13	17	33	20	...	...	...	2	2	1	3					

Contents of Sál trees.

CLASS V—1′-6″ AND BELOW IN GIRTH—*continued.*

Serial number of tree	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth	Reducing factor for			
	Girth at breast height	Height of tree	Length of timber-yielding bole.	Timber.					Fuel	Total volume of tree.		Sawyers' timber	Timber of all kinds.	Fuel	Entire tree
				Sawyers' timber			Tors and ballis.	Total.							
				In bole.	In branches	Total									
	Inches.	Feet	Feet.												
14	17	25	20	..	...	...	3	3	...	3					
15	17	27	15	...	...	...	2	2	1	3					
16	17	22	12	...	...	...	1	1	1	2					
17	16	47	30	...	...	.	4	4	...	4					
18	16	26	15	...	...	..	2	2	1	3					
19	16	37	15	...	...	...	2	2	1	3					
20	16	30	12	...	...	...	1	1	1	2					
21	16	40	15	...	...	..	1	1	1	2					
22	16	32	18	...	...	...	2	2	...	2					
23	16	20	12	...	...	...	1	1	1	2					
24	16	37	12	..	...	...	1	1	1	2					
25	16	32	15	...	...	...	1	1	1	2					
26	16	32	10	...	...	...	1	1	1	2					
27	16	26	12	...	...	...	1	1	1	2					
28	16	20	..	...	...	...	...	...	1	1					
29	16	22	12	...	...	...	1	1	...	1					
30	16	25	12	..	...	...	1	1	...	1					
31	16	18	...	...	...	...	...	...	1	1					
32	15	38	18	...	...	...	2	2	1	3					
33	15	30	15	...	...	...	2	2	...	2					
34	15	36	18	...	...	...	2	2	...	2					
35	15	34	16	..	...	...	1	1	1	2					
36	15	38	12	...	...	...	1	1	1	2					
37	14	40	20	...	...	...	2	2	1	3					
38	14	34	10	...	...	...	1	1	1	2					
39	14	32	20	..	...	...	2	2	...	2					
40	14	34	15	..	...	...	1	1	1	2					
41	14	20	10	...	...	...	1	1	1	2					
42	14	28	12	.	...	...	1	1	...	1					
43	14	25	15	...	...	...	1	1	...	1					
44	14	29	12	..	..	.	1	1	...	1					
45	14	31	15	...	..	...	1	1	...	1					
46	14	26	12		...	..	1	1	...	1					
47	14	24	12	...	...	...	1	1	...	1					
48	14	20	12	.	...	...	1	1	...	1					
49	14	24	15	...	..	...	1	1	...	1					
50	14	20	...	..	...	...	...	...	1	1					
51	14	25	15		...	..	1	1	...	1					
52	14	20	15		...	...	1	1	...	1					
53	14	22	12	...	...	...	1	1	...	1					

Contents of Sál trees.

CLASS V—1′-6″ AND BELOW IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth	Reducing factor for			
				Timber.											
				Sawyers' timber			Tors and ballis.	Total.	Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total.									
	Inches.	Feet.	Feet.												
54	14	28	15	...	...	...	1	1	...	1					
55	13	26	...	...	...	...	...	...	1	1					
56	13	24	15	...	...	...	1	1	...	1					
57	13	30	12	...	...	...	1	1	...	1					
58	13	22	15	...	...	...	1	1	...	1					
59	13	25	12	...	...	...	1	1	...	1					
60	12	32	18	...	...	...	2	2	...	2					
61	12	26	...	...	...	...	...	...	1	1					
62	12	28	18	...	...	...	1	1	...	1					
63	12	27	15	...	...	...	1	1	...	1					
64	12	30	15	...	...	...	1	1	...	1					
65	12	20	12	...	...	...	1	1	...	1					
66	12	33	15	...	...	...	1	1	...	1					
67	12	19	...	...	...	...	...	...	1	1					
68	12	24	12	...	...	...	1	1	...	1					
69	12	22	15	...	...	...	1	1	...	1					
70	12	26	15	...	...	...	1	1	...	1					
71	12	25	12	...	...	...	1	1	...	1					
72	12	20	...	...	...	...	...	...	1	1					
73	12	28	12	...	...	...	1	1	...	1					
74	12	22	12	...	...	...	1	1	...	1					
75	12	24	10	...	...	...	1	1	...	1					
76	12	27	15	...	...	...	1	1	...	1					
77	12	22	12	...	...	...	1	1	...	1					
78	11	28	15	...	...	...	1	1	...	1					
79	11	24	15	...	...	...	1	1	...	1					
80	11	21	15	...	...	...	1	1	...	1					
81	11	19	...	...	...	...	...	...	1	1					
82	11	28	..	...	...	...	...	...	1	1					
83	11	21	...	...	...	...	...	...	1	1					
84	11	19	...	...	...	...	...	...	1	1					
85	11	19	...	...	...	...	...	...	1	1					
86	11	23	...	...	...	...	...	...	1	1					
87	11	21	...	...	...	...	...	...	1	1					
88	11	23	15	...	...	...	1	1	...	1					
89	11	21	...	...	...	...	...	...	1	1					
90	11	22	12	...	...	...	1	1	...	1					
91	11	26	12	...	...	...	1	1	...	1					
92	11	34	20	...	...	...	1	1	...	1					
93	11	16	...	...	...	...	...	...	1	1					

Contents of Sál trees.

CLASS V—1′-6″ AND BELOW IN GIRTH—*concluded.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber yielding Lok.	Timber.					Fuel.	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber			Tors and ballis.	Total.							
				In bole.	In branches.	Total.									
	Inches.	Feet.	Feet.												
94	11	25	15	...	...	...	1	1	...	1					
95	11	20	12	...	...	...	1	1	...	1					
96	11	22	12	...	...	...	1	1	...	1					
97	11	21	15	...	...	...	1	1	...	1					
98	11	25	10	...	...	...	1	1	...	1					
99	11	16	...	...	...	...	...	...	1	1					
100	11	18	...	...	...	...	...	...	1	1					
101	10	16	..	...	...	...	...	...	1	1					
102	10	18	...	...	...	...	...	...	1	1					
103	10	19	...	...	...	...	...	...	1	1					
104	10	16	...	...	...	...	...	...	1	1					
105	10	22	...	...	...	...	...	...	1	1					
106	10	14	...	...	...	...	...	...	1	1					
107	10	18	...	...	...	...	...	...	1	1					
108	10	22	15	...	...	...	1	1	..	1					
109	10	25	12	...	...	...	1	1	1	2					
110	10	26	15	...	...	...	1	1	...	1					
111	10	22	15	...	...	...	1	1	...	1					
112	10	24	15	...	...	...	1	1	...	1					
113	10	18	12	...	...	...	1	1	...	1					
114	10	18	...	...	...	...	...	...	1	1					
115	10	16	...	...	...	...	...	...	1	1					
Totals	1,533	2,992	1,295	...	...	...	120	120	59	179					
Averages	13	26	15	...	...	...	1	1	0·5	1·5	2	...	0·5	0·2	0·7

APPENDIX V.

Contents of Sain trees.

CLASS I—ABOVE 6′ IN GIRTH.

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				Sawyers' timber			Tops and ballis.	Total							
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	In bole.	In branches.	Total.						Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Inches.	Feet.	Feet.												
1	83	83	30	41	101	142	8	150	27	177					
2	82	77	50	82	...	82	...	82	64	146					
3	81	80	50	76	...	76	...	76	71	147					
4	79	107	60	82	56	138	8	146	33	179					
5	73	77	60	86	17	103	17	120	29	149					
Totals	398	424	250	367	174	541	33	574	224	798					
Averages.	80	85	50	73	35	108	7	115	45	160	238	0·45	0·48	0·19	0·67

CLASS II—ABOVE 4′-6″ AND UP TO 6′ IN GIRTH.

1	69	77	40	59	...	59	...	59	15	74					
2	68	68	40	30	34	64	30	94	17	114					
3	67	74	40	43	...	43	6	49	Not	measured					
4	67	65	40	32	...	32	4	36	37	73					
5	65	74	40	52	5	57	10	67	19	86					
6	65	72	40	47	32	79	4	83	Not	measured					
7	63	75	50	38	...	38	7	45	Not	measured					
8	62	66	40	46	...	46	...	46	Not	measured					
9	61	60	40	49	...	49	...	49	30	79					
10	59	69	40	27	27	54	26	80	18	98					
11	59	62	40	33	7	40	18	58	Not	measured					
12	59	72	40	37	...	37	6	43	25	68					
13	59	64	50	45	...	45	4	49	Not	measured					
14	58	65	30	21	13	34	8	42	18	60					
15	57	62	40	40	7	47	8	55	Not	measured					
16	56	66	40	28	19	47	3	50	Not	measured					
17	56	65	50	45	...	45	5	50	Not	measured					
18	56	68	50	39	5	44	5	49	Not	measured					
19	56	65	30	36	...	36	...	36	24	60					
Totals	1,162	1,289	780	747	149	896	144	1,040	203	712					
Averages.	61	68	41	39	8	47	8	55	23	79	110	0·43	0·50	0·21	0·71

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH.

1	54	60	30	28	...	28	...	28	...	...					
2	52	60	30	20	7	27	10	37	...	...					
3	52	62	40	33	...	33	...	33	...	...					
4	51	60	40	38	7	45	...	45	...	...					
5	51	60	10	13	...	13	27	40	...	...					

Contents of Sain trees.

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
				Timber.					Fuel.	Total volume of tree.					
				'Sawyers' timber			Tops and butts.	Total.				Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
	Girth at breast height	Height of tree.	Length of timber-yielding bole.	In bole.	In branches	Total.									
	Inches.	Feet.	Feet.												
6	51	60	40	28	5	33	4	37	...	...					
7	51	62	40	26	...	26	6	32	...	...					
8	51	64	40	24	...	24	5	29	...	...					
9	51	60	30	26	...	26	...	26	...	...					
10	50	60	40	31	7	38	7	45	11	56					
11	50	65	50	26	...	26	9	35	...	...					
12	50	68	40	24	...	24	3	27	14	41					
13	49	57	40	27	11	38	7	45	...	...					
14	49	56	30	21	6	27	11	38	...	...					
15	49	58	40	27	...	27	10	37	...	...					
16	49	59	30	24	...	24	3	27	...	...					
17	48	58	40	18	6	24	12	36	9	45					
18	48	56	40	30	...	30	4	34	...	...					
19	48	55	40	26	...	26	6	32	...	...					
20	48	58	40	28	...	28	...	28	...	...					
21	48	55	30	17	5	22	5	27	...	...					
22	48	57	40	22	...	22	3	25	13	38					
23	48	58	30	24	...	24	...	24	...	...					
24	47	54	30	16	...	16	4	20	...	...					
25	46	50	30	16	5	21	13	34	...	...					
26	46	55	40	29	...	29	3	32	...	...					
27	46	55	30	24	...	24	...	24	...	...					
28	45	55	30	16	18	34	6	40	...	...					
29	45	55	40	20	...	20	8	28	...	...					
30	45	52	30	20	...	20	...	20	...	...					
31	44	62	50	31	...	31	...	31	...	...					
32	44	55	40	21	...	21	3	24	...	...					
33	44	54	40	21	...	21	3	24	...	...					
34	44	54	40	16	...	16	8	24	14	38					
35	43	52	40	21	...	21	8	29	...	...					
36	43	50	40	24	...	24	4	28	...	...					
37	43	52	40	21	...	21	5	26	...	...					
38	43	52	40	24	...	24	...	24	...	...					
39	43	45	30	20	...	20	..	20	...	..					
40	43	52	30	19	...	19	...	19	...	...					
41	42	52	40	18	..	18	12	30	...	...					
42	42	52	40	12	...	12	16	28	..	...					
43	42	52	30	19	8	27	...	27	...	...					
44	42	50	30	14	...	14	13	27	...	...					
45	42	50	40	24	..	24	2	26	..	...					

Contents of Sain trees

CLASS III—ABOVE 3′ AND UP TO 4′-6″ IN GIRTH—*continued.*

Serial number of tree.	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber.					Fuel.	Total volume of tree.		Sawyers' timber	Timber of all kinds.	Fuel.	Entire trees.
				Sawyers' timber.			Tops and ballis.	Total.							
				In bole.	In branches.	Total.									
	Inches	Feet	Feet.												
46	42	52	40	20	...	20	2	22	...	...					
47	41	50	40	29	...	29	...	29	...	...					
48	41	57	40	21	...	21	7	28	...	...					
49	41	50	30	15	...	15	12	27	...	...					
50	41	50	30	8	8	16	10	26	...	...					
51	41	50	30	17	...	17	8	25	...	...					
52	41	59	40	19	...	19	3	22	...	...					
53	41	50	20	14	...	14	8	22	...	...					
54	41	50	30	14	...	14	3	17	12	29					
55	41	56	40	14	...	14	5	19	...	...					
56	41	51	40	13	...	13	5	18	..	..					
57	41	48	20	13	..	13	4	17	...	...					
58	40	46	20	12	...	12	14	26		...					
59	40	51	40	13	...	13	11	24	...	...					
60	40	48	30	13	...	13	6	19	...	...					
61	40	44	30	8	...	8	6	14	...	...					
62	39	48	40	14	..	14	5	19	..	...					
63	39	47	40	15	..	15	4	19	...	...					
64	39	43	30	8	...	8	4	12	..	...					
65	38	48	40	15	...	15	8	23	..	...					
66	38	46	20	12	...	12	7	19	...	...					
67	38	46	30	10	...	10	8	18	...	...					
68	37	48	30	12	...	12	6	18	15	33					
Totals	3,031	3,666	2,380	1,356	93	1,449	386	1,835	88	280					
Averages	45	54	35	20	1	21	6	27	13	40	47	0 45	0 57	0 28	0 85

CLASS IV—ABOVE 1′-6″ AND UP TO 3′ IN GIRTH.

1	36	48	30	11	...	11	4	15	..	...					
2	36	48	30	11	...	11	3	14	...	...					
3	36	45	30	11	..	11	3	14	..	...					
4	36	48	30	11	...	11	3	14	...	...					
5	35	47	20	7	...	7	6	13	.	...					
6	35	40	20	11	.	11		11	..	...					
7	34	45	30	6	...	6	7	13		...					
8	34	44	20	9	..	9	2	11	.	.					
9	34	45	20	6	...	6	3	9	...	...					
10	33	55	30	8	...	8	8	16	...	...					
11	33	48	40	9	...	9	5	14	...	...					
12	33	42	30	9	...	9	3	12	...	...					

Contents of Sain trees.

CLASS IV—ABOVE 1′-6″ AND UP TO 3′ IN GIRTH—*concluded.*

Serial number of tree	Dimensions of the trees.			Actual contents of the trees in cubic feet.							Contents in cubic feet of the trees by square of quarter girth.	Reducing factor for			
	Girth at breast height.	Height of tree.	Length of timber-yielding bole.	Timber					Fuel	Total volume of tree.		Sawyers' timber.	Timber of all kinds.	Fuel.	Entire tree.
				Sawyers' timber.			Tors and ballis.	Total							
				In bole.	In branches	Total									
	Inches.	Feet.	Feet.												
13	33	37	20	5	..	5	3	8	...	...					
14	32	42	30	9	...	9	5	14	...	...					
15	32	44	20	6	...	6	3	9	...	...					
16	32	43	20	5	...	5	4	9	...	...					
17	32	43	20	5	...	5	4	9	...	...					
18	31	42	20	5	...	5	6	11	...	...					
19	31	42	30	5	...	5	6	11	...	...					
20	31	55	30	3	...	3	6	9	...	...					
21	31	43	20	4	...	4	4	8	...	...					
22	31	41	20	5	...	5	3	8	...	...					
23	31	42	20	4	...	4	3	7	...	...					
24	30	52	40	9	...	9	11	20	...	...					
25	30	40	30	5	...	5	7	12	...	...					
26	29	40	20	5	...	5	5	10	...	...					
27	29	40	10	4	...	4	4	8	...	...					
28	29	41	20	3	...	3	3	6	...	...					
29	29	30	10	4	...	4	...	4	...	...					
30	28	40	10	4	...	4	9	13	...	...					
31	28	40	20	4	...	4	4	8	..	...					
32	28	38	20	3	...	3	3	6	...	...					
33	27	38	20	4	...	4	7	11	...	...					
34	27	37	20	3	...	3	6	9	...	...					
35	27	38	30	4	...	4	3	7	...	...					
36	25	36	20	...	...	...	6	6	...	...					
37	25	35	20	...	...	...	6	6	...	...					
38	24	35	20	...	...	...	5	5	...	...					
39	22	34	10	2	...	2	...	2	...	...					
40	21	30	10	...	...	...	3	3	...	...					
Totals	1,220	1,673	910	219	...	219	176	395	...	...					
Averages.	31	42	23	5	...	5	4	10	...	...	18	0·28	0·56	...	...

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